Radio, Electronics and Communications

FORMERLY "RADIO & ELECTRICAL REVIEW" — WIDELY KNOWN SINCE 1946 AS "R. & E."

MPL

In This Issue . . .

- Looking At Medical Electronics.
- The Qualitative Manufacture of Telephone cable.
- Tape Topics — Part II.
- N.Z.E.I. — Annual Conference.
- A Transistercom.
- Laboratory Report, Serviceman's Column.

PUBLISHED MONTHLY IN THE INTERESTS OF THE N.Z. ELECTRONICS INDUSTRY FOR ALL LEVELS, FROM PROFESSIONAL TO AMATEUR.

VOLUME 20 NUMBER 5

JULY 1, 1965

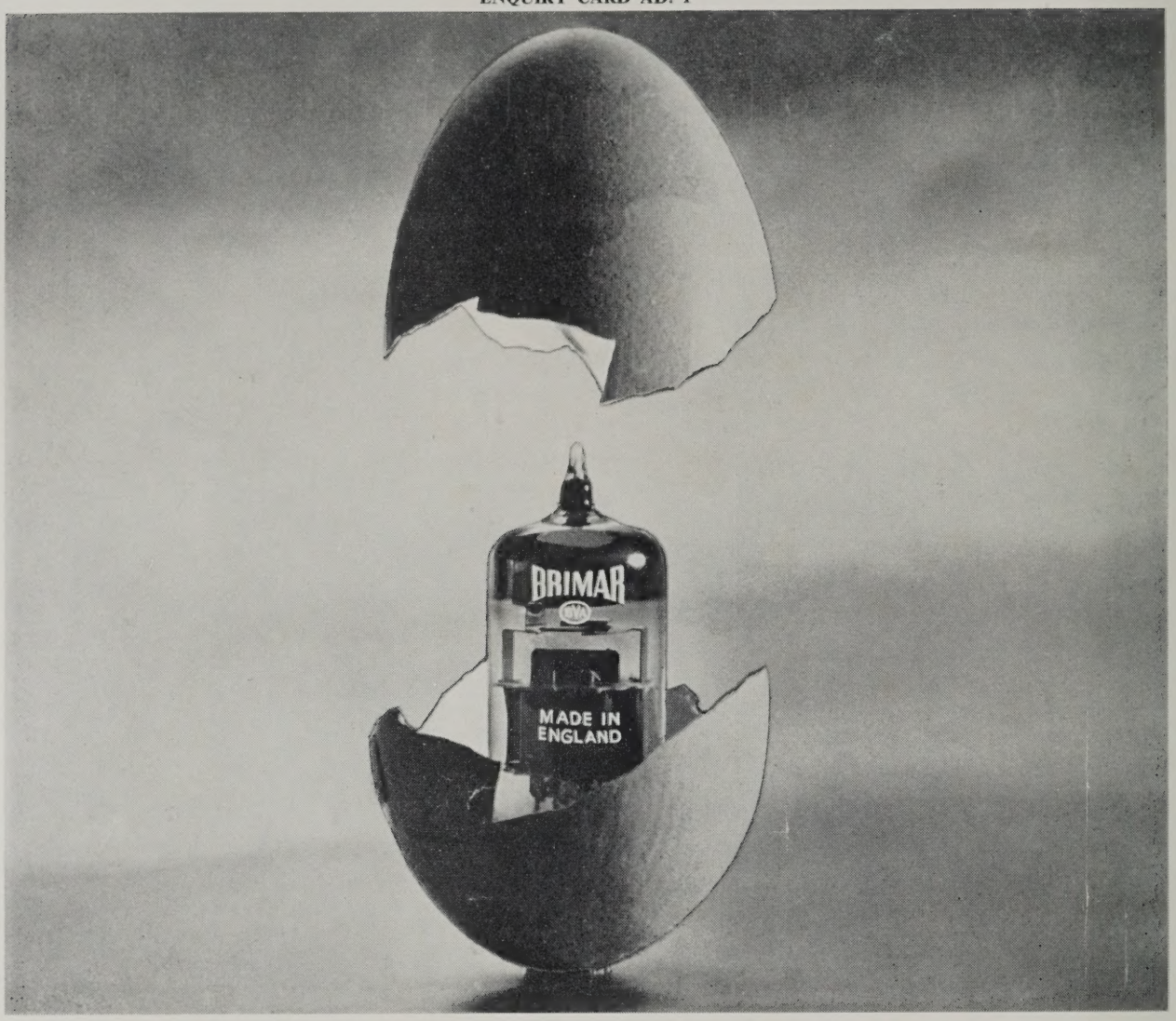
PRICE 2/6

Instruments exported to Canada by AWA Sydney

AWA

SEE PAGE 5.

ENQUIRY CARD AD. 1



The shell of an egg contains the secret of reproduction. So too, in a different sense, does a Brimar valve. For true-to-life reproduction and consistent reliability,

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Standard Telephones and Cables (Pty.) Limited AN ITT ASSOCIATE

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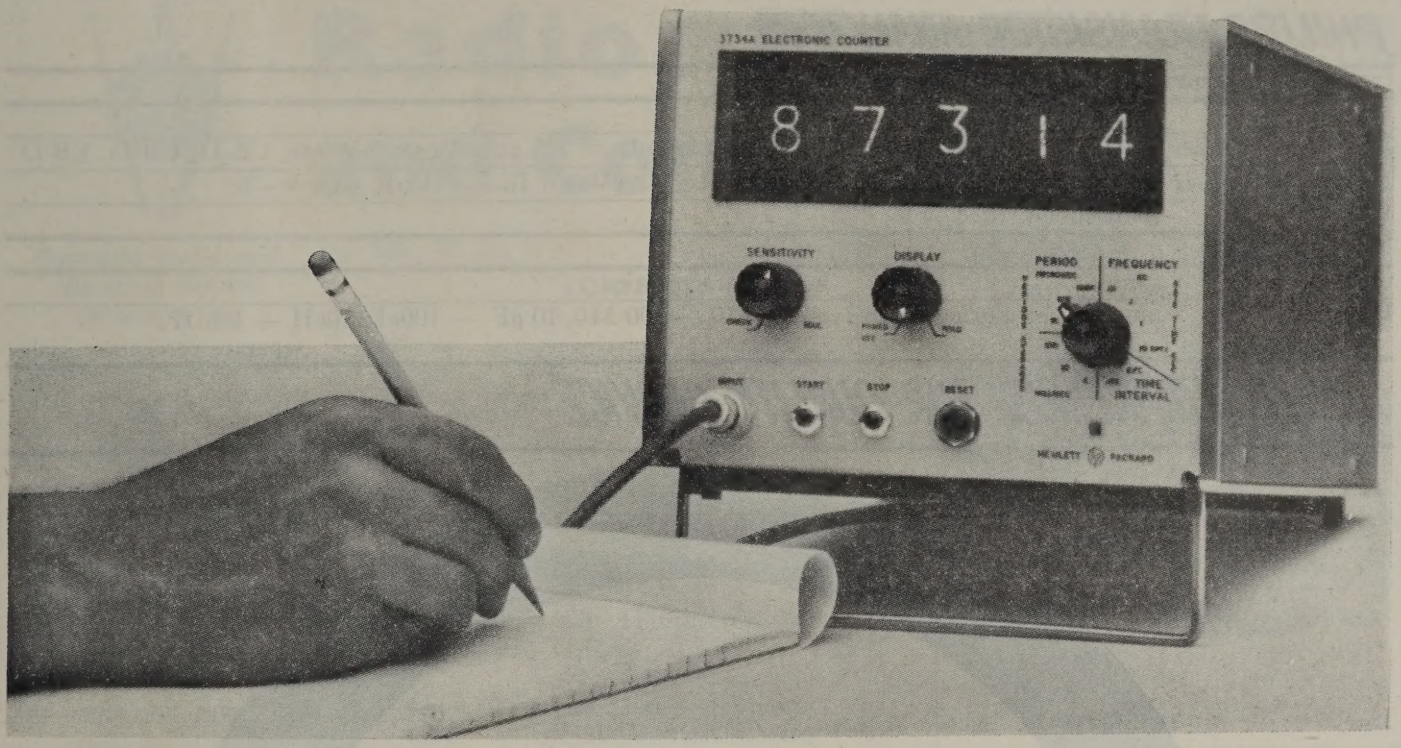
ENQUIRY CARD AD. 2



General Purpose Counter—only $1075!

New compact, solid–state, 2 mc electronic counter

Here's the new Hewlett–Packard Model 3734A Counter—only 8" wide and 6" high—ideal for bench use, yet easily rack mounted (with room for another modular hp instrument in a standard rack width).

Measure frequency ratio and multiple ratio
Make cumulative measurements
Measure frequency — 2 cps to 2 mc
Measure period and multiple period average
Measure time interval

With five–digit in–line readout, the 3734A displays any of these measurements in clear, easily read numerals. High sensitivity and a one–megohm input impedance assure accurate measurement of signals as low as 100 mv rms. The decimal is automatically positioned.

The internal time base is a stable 100 kc oscillator —an external time base may be used if desired.

Display storage provides a continuous display of the most recent measurement, changing only when the count actually changes; a display control, adjustable 0·2 to 5 seconds, can be used to set the period of time between the end of one count and the start of the next. A reset disable function permits cumulative measurements.

Front–panel pushbuttons provide convenient manual control in time interval mode—for electrical operation there are separate start–stop inputs on the rear panel.

The size of the counter and a tilt stand provided for easy viewing make it ideal for bench use. At only 12½ pounds, it is excellent for portable applications. Price: hp 3734A, $1075.

HEWLETT hp PACKARD
An extra measure of quality

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TELEPHONE 565-361

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ENQUIRY CARD AD. 3

PHILIPS TRANSISTOR ANALYZERS

transistor measuring equipment

type		tests
PM 6505	analyser	short-circuit, I_{CEO}, I_{CBO}, I_{EBO}, $I_C = f(I_B)$, $I_C = f(V_{BE})$, V_{CEK}, hie, hfe, CE-D, CB-D, EB-D
PM 6503	analyser	short-circuit, I_{CEO}, I_{CEK}, $I_C = f(I_B)$, $I_C = f(V_{BE})$, $I_D = f(V_D)$, αfe, α—fe
PM 6501	tester	short-circuit, I_{CEO}, αfe

bridges

type	name	main characteristics
PM 6301	universal measuring bridge	ranges: 1Ω — 100 MΩ, 10 pF — 100μF, 10μH — 100 H; separate percentage scale

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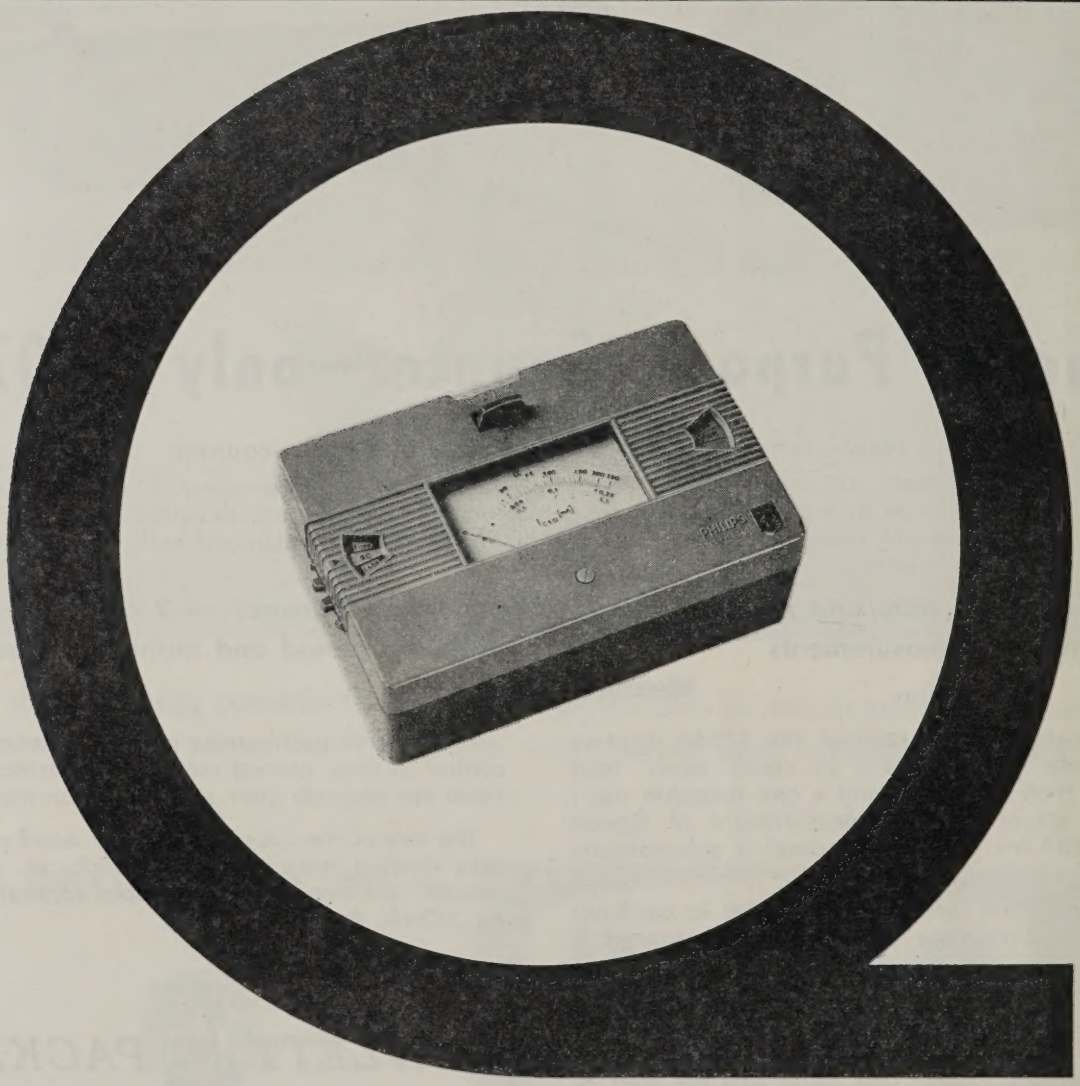

For further information please contact:

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Vol. 20, No. 5 July 1, 1965

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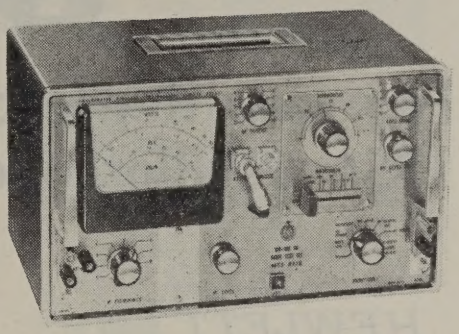
On Our Cover



One of the latest Modular Test sets manufactured by the Instrument factory of Amalgamated Wireless (Australasia) Limited, Sydney, is the A410, illustrated.

The Canadian Marconi Company recently ordered 25 AWA A410 VHF/UHF FM Radio Equipment Test sets. A good export future is predicted for the MTS range of instruments.

The A410 is fully transistorised, light and portable for field testing of FM transmitters and receivers in the VHF and UHF bands.

ENQUIRY CARD AD. 4

COMING . . .

Square-Wave Testing
Introduction to Communications Receiver Design
Communication Series — continued
Some Applications of Digital Electronics in Industry
Transistorised Hi-Fi
New Tower for British Post Office

Also . . .

Circuit & Service Data
Serviceman's Column
New Products
Listening Post
Book Reviews

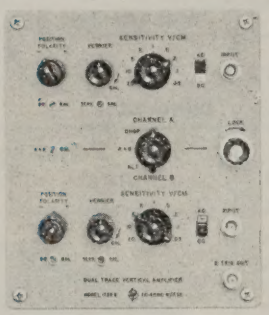
ENQUIRY CARD AD. 5

3 more Plug-ins

For your Hewlett Packard 175A Oscilloscope system

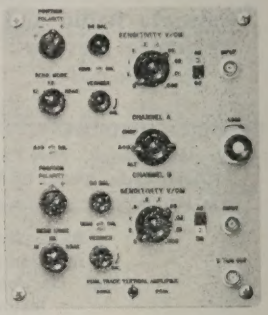
1750 B
50 mc Dual Trace

Maximum Sensitivity is 50 mV/cm. Simplified triggering insures stable dual trace display.

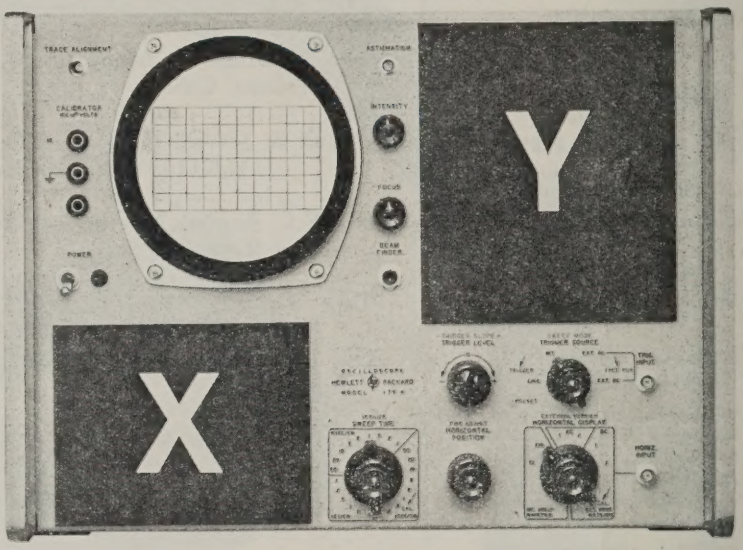


1775 A
High Sensitivity Dual Trace

With one plug-in: High Frequency (50 mc, 10mV/cm) or Low Level (20 mc, 1 mV/cm) operation. DC or AC coupled. Simplified triggering as in 1750 B.

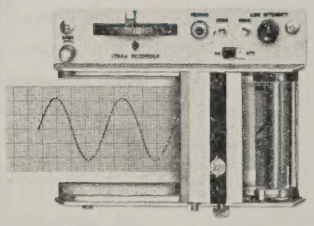


HEWLETT PACKARD hp *An extra measure of quality.*



1784 A
Strip Chart Recorder

Just push a button to automatically record repetitive waveforms to 30 mc. Cost is 1/20th that of standard photograph.



	175A Oscilloscope	(without plug-ins)		$1325·00
	ADDITIONAL PLUG-INS FOR 175A OSCILLOSCOPE			
Y	1751A Single Channel Amplifier	50 mc	50 mV/cm	$160·00
Y	1752B High Gain Amplifier	30 mc (or 40 mc)	5 mV/cm (50 mV/cm)	$285·00
Y	1754A Four Channel Amplifier	40 mc	50 mV/cm	$595·00
X	1781B Sweep Delay Generator	offers four different sweep modes		$325·00
X	1782A Display Scanner	for transferring CRT picture to x–y–recorder		$425·00
X	1783A Time Mark Generator	supplies 10μsec, 1μsec, 0·1μsec markers with 0·5% accuracy		$130·00

Prices are subject to change without notice. Equivalent New Zealand prices available upon request

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S

Letters from Readers

Sir,

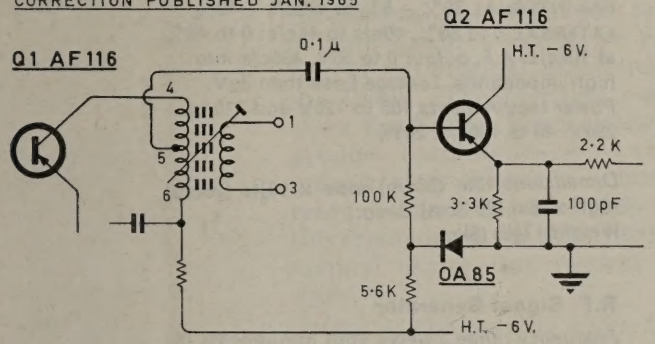
I have recently constructed the Transistorised Hi Fi Tuner, described in the Oct. edition of R. E. & C., 1964. However when completed and tested it oscillated, spoiling the performance of the tuner.

After some experimenting and the help of a local serviceman, it was found by changing the circuit, as shown in the diagram, the tuner performed properly.

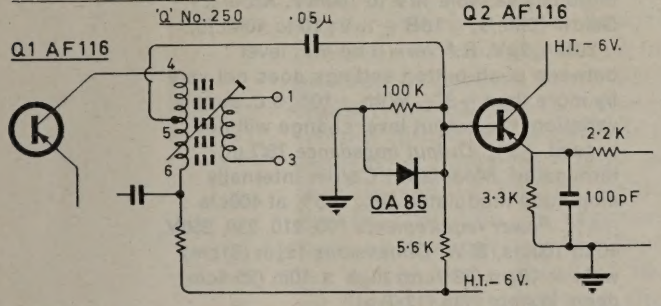
Could you please tell me if there is a missprint in the book or is my tuner at fault? If my tuner is at fault can you suggest any remedies?

B. BELLINI,
Rotorua.

CIRCUIT OF TUNER IN ORIGINAL ARTICLE (NOV. 1964) WITH THE CORRECTION PUBLISHED JAN. 1965



CIRCUIT SHOWING CHANGES MADE TO HI-FI TUNER BY READER B. BELLINI



There was one small error in the original circuit published in the October 1964 issue. This was noted as a correction in the Jan. 1965 copy. The circuit shown herewith is the correct version. Although there is a general similarity in the two circuits, there is one very important difference. In the system as shown by B. Bellini, the OA85 diode is effectively connected across the tuned circuit and therefore will cause severe damping of this circuit. This will reduce the working "Q", together with the gain and selectivity of the R.F. stage. This is probably the reason why the tuner now operates, although it will not perform up to expectations.

In the original design the detector operates in an emitter-follower "Class B" mode and this does not introduce the heavy damping on the tuned circuit that the shunt diode will produce.

The author has investigated several reports of instability in the R.F. stage of this tuner. In all cases this has been caused by poor layout of the coils, permitting the collector coil to be inductively coupled to the aerial-base coil. It is recommended that the coils should be shielded with a metal shield so that one coil cannot "see" the other in any way. Some attention should also be paid to the leads from the coils, running to the condenser gang. These should be as short as possible and not run close to each other.

If this is checked, you should have no further trouble using the corrected circuit.

—Ed.

Sir,

I was looking back at an issue of Radio & Electrical Review magazine dated November 1, 1962. It was volume 17, No. 9, and I found a circuit for a mobile

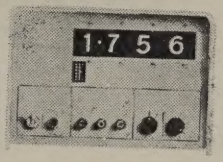
—Continued on page 37

ENQUIRY CARD AD. 6

INTERNATIONAL ELECTRONICS LTD. LONDON

NEW EQUIPMENT

DIGITAL VOLTMETER



The DSV.1 is an all solid state 1% Digital Voltmeter. The unique system of analogue digital conversion enables the unit to be produced at the low cost of £99.

SPECIFICATIONS:

Mains Input Voltage: 100/125 and 200/250V. 50/60/ c/s A.C.

Ranges:

Selector Switch Setting	Normal	Subtract 1,000
1V.	0.999V.	1.999V.
10V.	9.99V.	19.99V.
100V.	99.9V.	199.9V.
1000V.	999V.	

Input impedance: Range 1: 100,000 ohms
,, 2: 1 megohm
,, 3: 10 megohms
,, 4: 10 megohms

Accuracy: 0.1% ± 1 Digit.

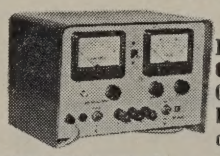
Sampling Rate: 20 per second.

Decimal Point Indication: Automatic with range switching.

Display: In line projection numerals.

A.C. Rejection: A built-in low pass filter gives 24 dB rejection at 50 c/s.

Controls: Mains on/off. Range switch. Subtract 1,000 switch. Pre-set: set 0 and calibrate (internal standard cell)



½ AMP BENCH POWER UNIT

Input voltages between 180 and 268V. Output continuously variable from 0.50V. Printed circuit design allows low price of £29/10/0.

SPECIFICATION:

Input Voltage: 180-268V. 50/60 c/s. A.C. No tapping panel. (110V. input on request)

Output voltage: 0-50V continuously variable, Isolated.

Output current: 0-500 mA

Regulation against load change: Better than 0.15% for any setting of output voltage.

Regulation against input change: Better than 0.075% for any 10% mains change

Ripple: 1 mV. R.M.S. Typical 1.5 mV. R.M.S. maximum

Protection: Continuously variable non re-entrant current protection. Over voltage transients on switching on and off are completely absent.

Minimum limiting current: 20 mA

Maximum limiting current: 550 mA

Metering: Dual range voltmeter (0-10V., 0-50V.) Separate independent ammeter.

Controls: Mains fuse. Mains Pilot Light. Mains on/off switch. Output on/off switch. Coarse and fine voltage setting control. Current limit control. Shorting push button. Voltmeter range switch.

Dimensions: 10" wide 8" deep 7" high

OTHER UNITS AVAILABLE INCLUDE

Various 2 and 5 amp bench power units. High and low voltage transistorised power supply units etc.

N.B. All prices shown above are British. New Zealand prices upon request. All the above equipment available from—

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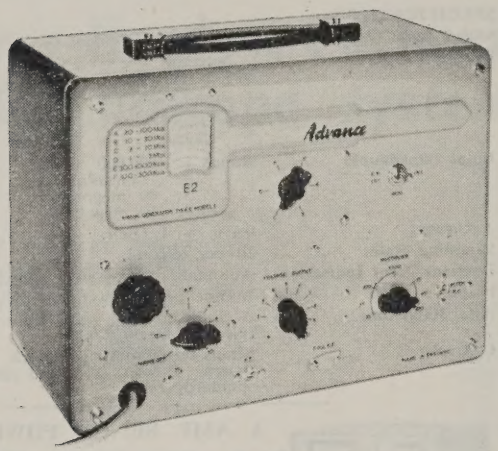
ENQUIRY CARD AD. 7

Advance r.f. signal generators

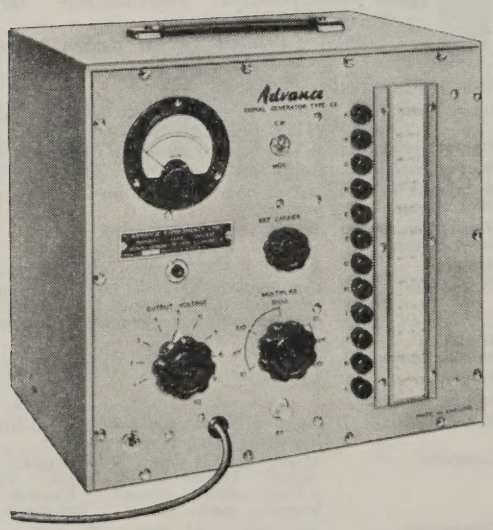


E2

R.F. Signal Generator

Frequency range 100kc/s to 100Mc/s in six bands. *Calibration accuracy* ±1%. *Output* Approximately 1V at the full R.F. socket. Continuously variable 1μV to 100mV. Accuracy of maximum output ±3dB. Accuracy of step attenuator ±(3dB + 3μV). *Output impedance* 75Ω unterminated. Normally this is matched with a 75Ω terminating pad TP1B, providing 37Ω, 10Ω and a standard 10Ω dummy aerial. *Modulation* INTERNAL 30% ±5% at 400c/s ±10%. EXTERNAL 0 to 80%, 10c/s to 4kc/s; 0 to 40% at 10kc/s. *A.F. output* 0 to 50V, 400c/s into high impedance. *Leakage* Less than 3μV. *Power requirements* 105 to 125V and 210 to 250V, 40 to 100c/s, 20W.

Dimensions 13in (33cm) wide × 10¼in (26cm) high × 8in (20·3cm) deep.
Weight 17½lb (8kg).



C2H

R.F. Signal Generator

Frequency range Twelve spot frequencies in the range 30kc/s to 40Mc/s. *Output* Continuously variable 1μV to 100mV. *Accuracy* Below 10Mc/s, ±1dB ±1μV; 10 to 40Mc/s, ±2dB ±2μV. *R.F. level* The R.F. level between push-button settings does not vary by more than ±3%. With ±10% a.c. supply variation, the output level change will not exceed ±3%. *Output impedance* 75Ω unterminated. *Modulation* Carrier internally amplitude modulated 30% ±5% at 400c/s ±5%. *Power requirements* 100, 210, 230, 250V, 40 to 100c/s, 25W. *Dimensions* 12¼in (31cm) wide × 13¼in (33·7cm) high × 10in (25·4cm) deep. *Weight* 28lb (12·7kg).

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FROM THE COMPREHENSIVE RANGE OF Advance INSTRUMENTS AND EQUIPMENT

The future of the Standards Institute

The announcement that the Standards Institute will be separated from the Department of Industries and Commerce should be welcomed but with some reservations. There is no doubt that separation from direct Government control will give the Institute greater freedom but the same separation will remove a source of finance that is firm and unalterable. Thus, our reaction is one of favour tempered with a little doubt because we remember the fate of the original Standards Institute in the 1930s. The Institute was established after the Napier Earthquake primarily to produce building codes — this was under industrial sponsorship — but it had to be rescued from financial difficulties by the Government in the mid 1930s and has remained under Government control ever since.

One of the reasons given for separation of the Institute from Government was that it was thought that there was some stigma attached to the Institute as a Government organisation. Whilst this may be true in certain other fields we do not think it is valid in the electrical and electronics industry. Whatever the reason for separation however, there is little doubt that it should be the vehicle for a far greater freedom of expression and attitude on the part of the Institute. There are major tasks ahead of the Institute in all fields, particularly in the building industry where many Standards and Codes of Practice are needed. Likewise, there are many gaps in the electrical and electronic field where Codes of Practice and Recommendations are needed. There is also a need for greater speed and efficiency so that once work is started there is a minimum of delay in getting down to the job. It is realised that the preparation of many Standards takes some time but it is very frustrating to learn that many Standards Committees only meet once or twice a year. One press report indicates that the new organisation will foster much more in the way of local committees and this should help to speed up the preparation of Standards and other documents.

For the first few years the Institute will be almost solely supported by the Government's contribution of about 80% of approximately £100,000 per annum. Presumably this sum has been based upon current requirements of the Industries and Commerce Department but it is hoped that within the framework of the new Institute there will be some provision for increased staff and more liberal salary scales. The existing staff at Standards are very much overworked and are, on outside scales, underpaid. This is where industry can give a lead. It seems that certain industrial groups put pressure on Government to make the Standards Institute independent so it is up to the same groups to put their hand in their pockets — and deeply at that — because a fate similar to that of the first body in the thirties would once and for all ensure Government control.

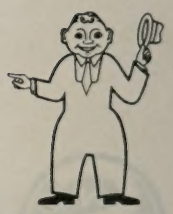
It is hoped that an organisation similar to the British Standards Institute will be used so that smaller companies or even individuals may become subscribing members and in return receive a specified number of documents each year. By this means even the small company or consulting partnership may contribute to the work of the Institute, say for two to five guineas annual subscription, receiving in return the right to obtain, say, ten or a dozen "free" Standards a year.

It is essential, then, for the large and the small to help the new Standards Institute next year. Half-heartedness will only bring a reversion to Government control because Standards are vital to this country's export drive. We feel that because industry requested Government to make this move it is essential that New Zealand industry as a whole should support the new arrangement. It will not be one that will return a quick profit, if any profit at all, but it is time that industry in New Zealand looked past the profit motive and more towards ethics.

ENQUIRY CARD AD. 8

PHILIPS

A New TV. Kitset



The completely new Kitset has been designed to fulfil the need of the advanced technician and amateur

PHILIPS 1965 TELEVISION KITSET FEATURES:— Printed circuit boards throughout • Pre-wired line output stage assembly • High-grade transformer and bridge rectifier • Voltage stabilisation • Suitable for either 19 inch or 23 inch picture tube • Chassis supplied with all cutouts etc. • Pre-aligned channel selector • Comprehensive construction manual • All components supplied, excluding connecting wire, picture tube and cabinet.

The 1965 Television Kit incorporates all features necessary for high-quality performance together with a style of construction within the capabilities of the average kitset enthusiast.

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Philips Replacement Parts
TV Kit Sets

WE SERVICE ALL BRANDS OF ELECTRONIC EQUIPMENT

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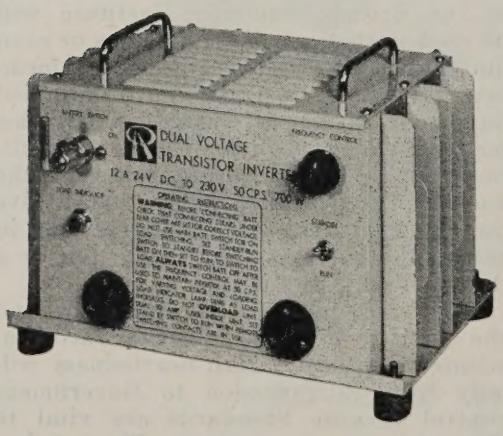
ENQUIRY CARD AD. 9

REDFERN 700 WATT DUAL INVERTER

MARINE, MOBILE RADIO, EMERGENCY POWER, CARAVANS, BUSES



The Redfern 700 Watt dual inverter is designed for higher power applications. The inverter may be used on 12V or 24V battery supplies by adjusting voltage change links on rear panel. The higher power capability makes the unit suitable for supplying small refrigerators, vacuum cleaners, emergency lighting or power supply circuits, ½" hand drills.

The unit is conservatively designed. Two A.C. outlets are provided. A standby run switch is fitted; control contacts are provided for switching inverter from a remote point. A step frequency control allows frequency to be adjusted to ± 1 C.P.S. of 50 C.P.S. A load indicator lamp permits a check of inverter operation.

SPECIFICATION:
12 or 24 Volt accumulator supply, dual inverter circuit internal fuses of 50 Amp rating. Load up to 800 Watts, output 230 V. 50 C.P.S. A.C. square wave adjustable to ± 1 C.P.S. Indicator lamp fitted, reverse polarity protection relay. Standby run switch, separate battery isolation switch, 12 transistors. Metal work plated and enamel finish, operating instructions printed on instrument. Battery voltage adjustments under rear panel cover.

LOADING:
The unit has been tested and found satisfactory on the following loads: vacuum cleaners, small refrigerators, ½" hand drills, filament lamps up to 550 Watts, electric hand mixers, fluorescent lamps up to 240 Watts, electric fans, testing instruments, radio receivers, communication receivers, transmitters up to 600 Watt A.C. loading, amplifiers, some television receivers, electric razors. The following loads are permissible but may give less satisfactory performance due to frequency variation: Tape recorders, gramaphone turntables.

MANUFACTURERS & DISTRIBUTORS

REDFERN RADIO

113 Great North Road, Glen Eden, Auckland

Looking at . . .

ELECTRONICS IN MEDICINE

Part III

The use of lasers in medicine follows the increased use of ultrasonics in surgery and therapeutic work but has caught the medical imagination far quicker possibly, it has been said, because it is nearer the physics taught at medical school!

The application of laser energy to medicine is primarily due to the large amount of energy that can be kept within very close physical limits. Whilst ultrasonic energy can be directed quite accurately, it can come nowhere near the narrow beams possible with lasers.

It is the high energy content confined into a narrow beam that has been the basis for most work to date; for instance a ruby laser can have a focal point ·1 mm in diameter with an energy equivalent to 10^6 watts/sq. cm. Such fine beaming gives a sharpness of a scalpel and in tumor surgery the heat of the laser beam can be used to cut away diseased or unwanted tissue.

Fig. 1. Commercial Laser Unit

In opthalmic surgery laser equipment has created the most interest on account of the very short pulses required to give useable "incisions". The very short pulses used are, quite often, past before the eye reflexes. The accuracy of aim possible allows the retina to be dealt with without injuring the iris. Work in New York on 85 cases treated with a ruby laser covered 47 patients with damaged retinas. The laser supplied energy in 500 microsecond bursts and no eye reflexes were reported and physicists calculated that the eye sees only about 1/2000th of the light and that for about 1/1000th of second.

Photocoagulation is one use for the laser that is a commercial possibility and laser units are already in production. Coagulation, by heat, is a method whereby a detached retina can be secured. Figure 1 shows a commercial unit and figure 2 the optical layout.

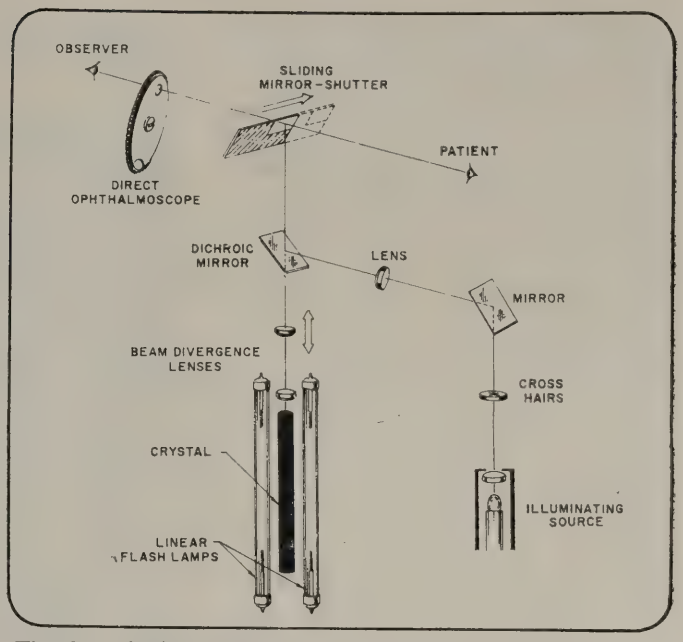


Fig. 2. Optical Layout

Alignment of the laser is carried out by a conventional optical source with the laser head as a hand-held unit. Cross hairs are projected for location of the beam onto the retina and the operator fires with a trigger on the head unit. The unit illustrated provides energy at 6943 Angstroms (a deep red), which is the best colour for transmission through the eye and ultimate absorption by the eye lining.

One hundred and twenty-five millijoules (1 joule equals 1 amp-second) of laser energy is available but this can be controlled. The pulse width is under half millisecond and up to six pulses per minute can be obtained. The published information on this unit details a beam divergence of as little as ·5° indicating the extremely fine tolerances possible. In addition to variable energy control, beam focussing is possible.

In other fields lasers are finding experimental use; dentistry is one field where the high energy is valuable when compacted into narrow beams. Two uses are the melting of dental fillings and the fusing of porcelain finishes. Natural coatings are also said to be enhanced by laser beam heating — akin to surface tempering of steel.

The range of "colours" available in lasers is finding use in biochemical fields where pigments and cells exhibiting colour discrimination can be either promoted or destroyed by laser beams.

Where ultrasonic applications only slowly increased, lasers in medicine may find more ready acceptance on account of the greater precision possible with such a coherent beam. At present, it is the cost barrier that has to be broken down as even the small photocoagulator illustrated costs over £2000.

For further information on the subjects covered we refer our readers to the references used in the preparation of this series — see page 35.

The R. E. & C. Transistercom

A VERSATILE SYSTEM

Here is a compact transistorised Intercom unit that will find a place in the home, office, shop or workshop. The unit can be used as a "baby-minder" in the nursery, for communication between front door and kitchen or kitchen and garage. For the radio serviceman or television antenna installation crew, this small compact unit, which can be held and operated with one hand, will form a useful tool. Electricians and plumbers will also find a small portable "Intercom" of use. The unit is battery powered, making it intrinsically safe, particularly where it will be used in the presence of children, or in damp surroundings. As transistors are used, there is no need to keep the equipment "alive" when not required, thus reasonable battery life is assured. Notwithstanding, the amplifier is capable of sufficient power to drive the 3 inch speakers adequately for most indoor and many outdoor applications.

The master and sub-station are both constructed in identical cabinets, as seen in the photograph. These cabinets were originally designed as sloping front cases to accommodate a standard 2½ inch diameter moving-coil meter. Our sample cabinets, readily available throughout the country, are manufactured by Fryco Products Ltd. of Auckland, and fabricated from panel steel finished with grey Hammertone spray paint. These cabinets have two holes punched on one edge, into which can be mounted the necessary switches, whilst the wide sloping front easily supports the 3 inch speaker together with expanded aluminium grille material. The nine volt battery is mounted vertically at the rear and the amplifier board is supported above the base, which is itself provided with four rubber grommetts as feet to prevent any damage to tabletops etc.

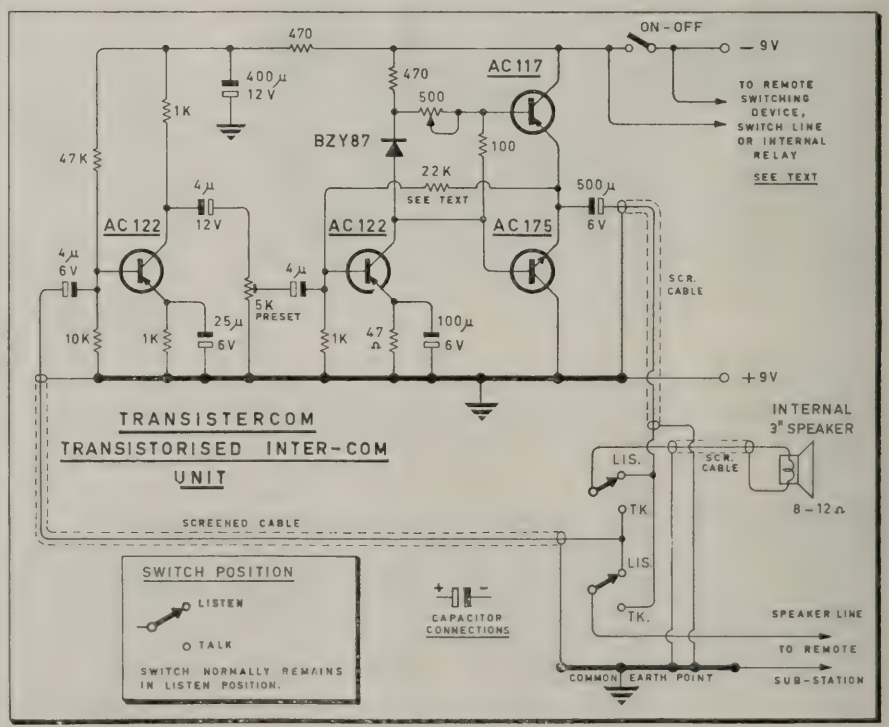
Whilst the amplifier is physically quite small, it is capable of producing fully half a watt. The main reason for the rather dramatic reduction in physical size is the absence of any transformers in the amplifier — this in turn stems from the use of the P.N.P. - N.P.N. complementary pair output stage used in this amplifier. To achieve the rated output power, it is necessary to use speakers with a reasonably high voice-coil impedance. The ones used here are 3" units with 10 ohm voice coils, assembled by D. J. Reid Ltd., and readily available throughout the country.

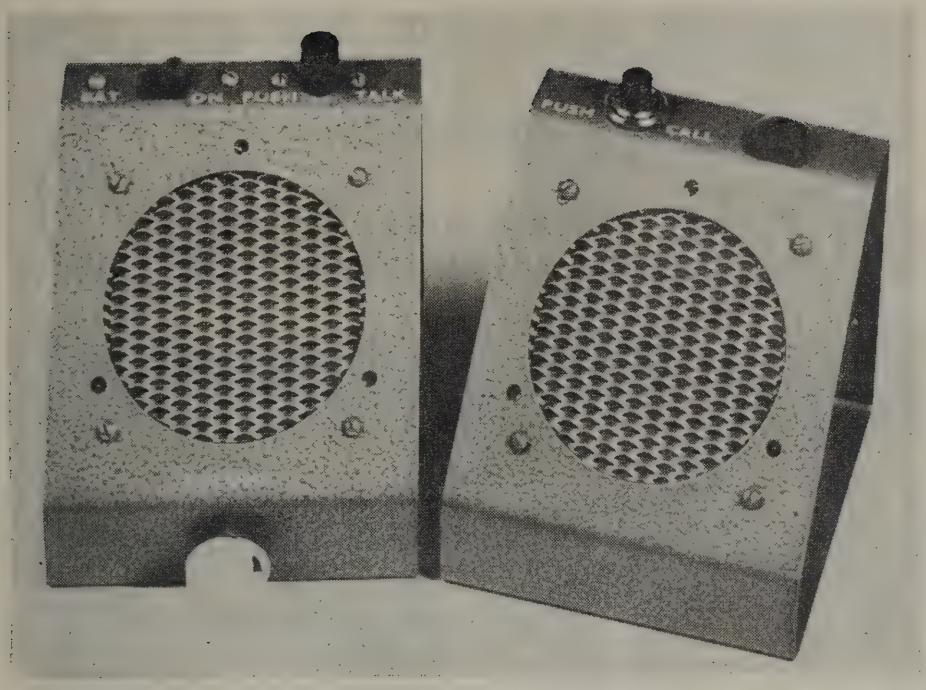
A brief description of the circuit is as follows:— The sound picked up by either the main or remote speaker (depending on the position of the talk-listen switch) is amplified in the first transistor, a Telefunken type AC122. The greatly amplified signal is passed via the volume control on the front panel to the second AC122 which serves as an amplifier and driver for the output stage.

This driver and output stage circuitry may appear a little unusual to readers who have been brought up on conventional transformer coupled transistorised Class B audio amplifiers. There is no driver transformer used and the two bases of the two output transistors appear to be connected together directly with a resistor, and indirectly through another resistor and a diode, connected to the collector of the driver transistor.

The mystery of the system is cleared up when it is realised that the output transistors are connected in series across the D.C. supply, and we use a P.N.P. and a N.P.N. transistor together. Both these transistors have similar characteristics but require D.C. and bias voltages of opposite polarity. The bases of the output transistors are maintained at a point about half the supply voltage.

The Telefunken BZY87 diode is included in the circuit to give a small but constant voltage difference between the bases of the two output transistors, so that they are slightly forward biased, and consequently drawing a few





milliamperes with no signal. This forward biassing is required to cause the transistors to operate, at low signal levels, outside the high distortion zero collector current cross-over point. Actually only a portion of the voltage developed across the BZY87 is used, the amount of forward bias being adjusted by the ratio of the 500 ohm preset potentiometer and the interbase 100 ohm resistance.

The output from the power amplifier section is coupled via the 500 mfd capacitor to the main or remote speaker, once again depending on the position of the talk-listen switch.

Construction of the Amplifier Section

The amplifier is constructed on a piece of thin paxolin sheet 3½ inches wide and 2½ inches deep. The largest component which must be mounted on this board is the 500 mfd. electrolytic used to couple the output stage to the speakers. All other components are physically quite small; ¼ watt resistors and electrolytics of similar size being used as these are quite readily obtainable from various sources.

In general the physical layout of the board follows very closely the circuit diagram. However, all the resistors are arranged along the rear edge of the board with the smaller capacitors arranged similarly along the front edge. This arrangement brings the two capacities connected to the volume control to the front near the rear of the control which is mounted on the lower edge of the cabinet below the speaker.

There is room at the rear for the 9 volt battery to stand vertically, being held with a simple metal bracket, underneath the slide switch which is used as an "on-off" control. The talk-listen switch is one of the type which became available in large quantities after the Second World War, being used in the famous Z.C.1. transceiver as the meter switch. There are however readily available D.P.D.T. push switches of similar construction, to be found on the various parts suppliers shelves, and in general these are more compact and therefore fit into the available space more easily.

There are some important points to be remembered in wiring and assembling this unit, to ensure trouble free operation. The first of these is the matter of earthing. This equipment uses one side of all lines earthed together, to reduce the number of contacts required on the "talk-listen" switch. However two wires are used to connect the main unit to the sub-station, to reduce the possibility of hum pickup on long lines. Under this system one side of the line to the sub-station, the input to the amplifier, the output from the amplifier, and the pair to the internal speaker are common. By the same token however, if these wires are all indiscriminately earthed, then there is a likelihood of instability occurring. For this reason the signal earth and the D.C. battery (earth) positive return are kept separate. The lead from the 500 mfd isolating capacitor to the T/L switch is shielded with the shield earthed to the positive rail at the same point as the collector of the AC175. The lead from T/L switch to emplifier input is also shielded with the shield earthed to the positive rail at the point where the emitter by-pass for the first AC122 is earthed. The leads from internal and external speakers are kept as a pair right to the T/L switch. Select a suitable spot near the terminals of the switch, and mount a large solder lug on the cabinet. At this point join the "earthy" sides of the speaker lines, and the braids of the two shielded cables.

The battery has the negative terminal connected via the switch to the common negative line (the collector of the AC117 etc.), whilst the positive terminal is connected directly to the positive rail at a point near the output transistors.

Remote "Call-In" Facility

Readers will also note in the circuit that a separate pair of wires is shown run to the sub-station unit This pair should be kept completely separate from those carrying signal voltages unless the relay control system is used (see later). If the distance between the main and sub-station is reasonably short, and the wire of reasonable thickness (such as "true-rip" lighting flex) then the battery can be switched directly. If the line is too long then the impedance of this battery line is sufficient to produce instability in

—Continued on page 35

ENQUIRY CARD AD. 10

AVO

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Precision Instruments

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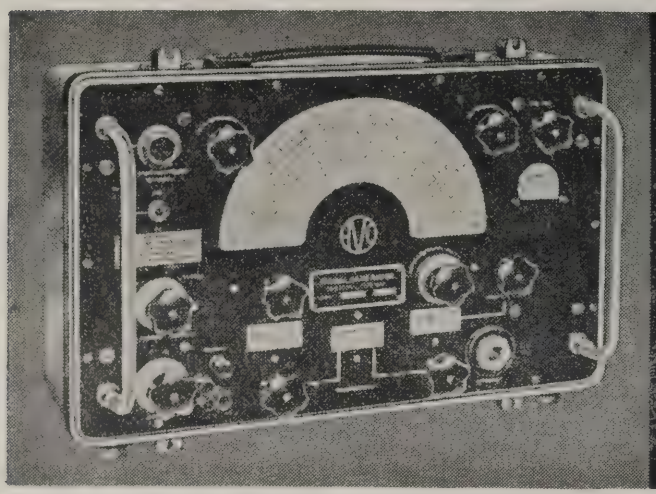

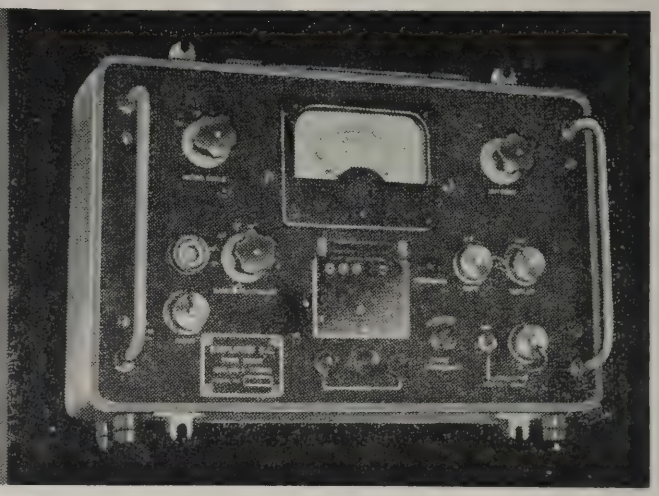

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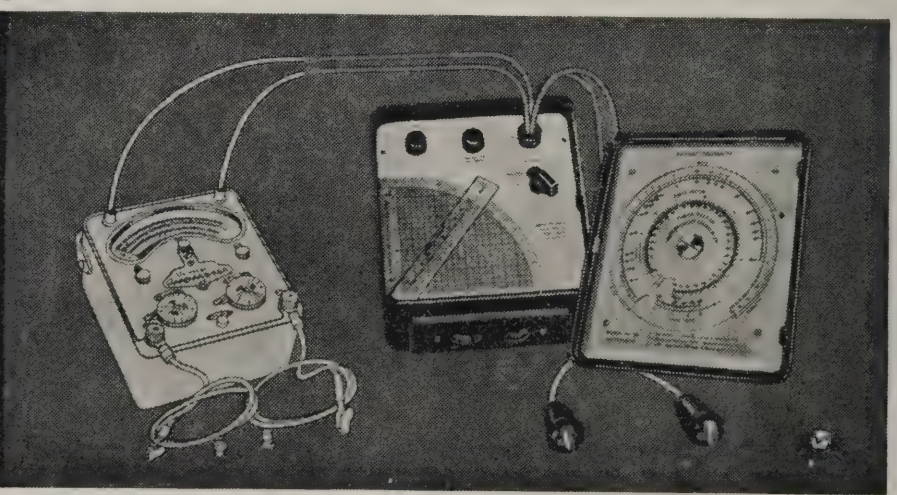
An inexpensive general purpose a.m. signal generator of entirely new design for the service engineer.
The new design of attenuator, coupled with adequate double r.f. screening, results in a remarkably close adherence of the output to the attenuator calibration, combined with a very low leakage figure.

AVO portable d.c. amplifier

A highly stable d.c. amplifier which has been primarily designed to measure the minute currents produced in ionization chambers, but it has applications in medicine, industry and experimental work in connection with reactor instrumentation.



AVO signal generator, Type 378

This instrument will provide r.f. signals between 1uV and 250mV into a 75 ohm load at any frequency between 2/Mc/s and 225/Mc/s, this being accomplished in 7 ranges.

Universal Avometer power factor and wattage unit

This unit which works in conjunction with the Model 7 AvoMeter or the Model 40 AvoMeter (2 models available) brings power factor and wattage measurements within the scope of every engineer without a great capital outlay.
The accuracy is far higher than is usually required for commercial purposes.
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QUALITATIVE MANUFACTURE OF TELEPHONE CABLE

D. J. GRAY, A.M.I.R.E.E. (Aust.), Assoc. I.E.R.E., Cable Engineer, Austral Standard Cables Pty. Ltd.

The telephone cable, whether it comprises one pair of wires or 3000 pairs, is the vital link in any communications system over wires. The quality and reliability therefore of any such link are of paramount importance in ensuring the proper functioning, at all times, of the relevant signalling and speech circuits.

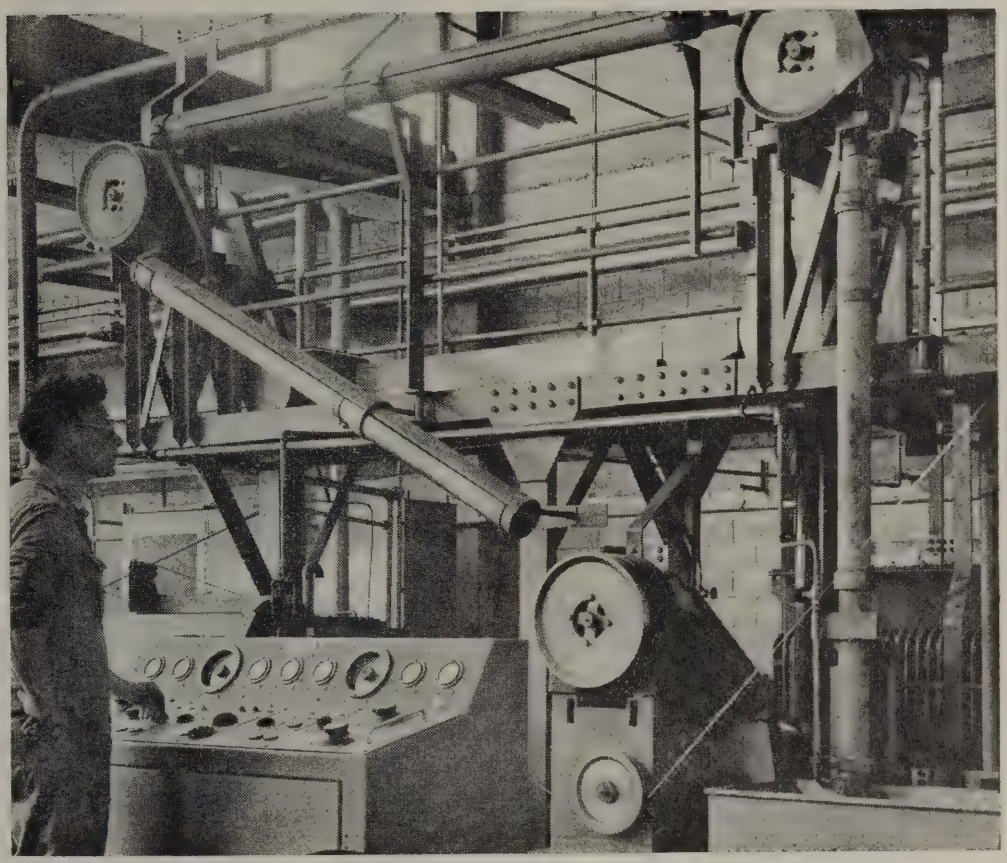
It is axiomatic that the reliability of a telephone cable is related, not only to the quality of workmanship and products used in its manufacture, but to the consistent quality of these two items. This consistency of quality can only be achieved by the compliance, at all times, with relevant standard specification at each stage in the manufacturing process. Such specifications would include, for example, British, New Zealand, and internal specifications which, over all, would provide those minimum requirements necessary to ensure an adequate and uniform quality throughout manufacture.

The basic cable types presently manufactured by the Christchurch factory of Austral Standard Cables Pty. Ltd. comprise:

- Unit type
- Quad type
- Plastic, in either polythene or P.V.C.

The conductor material, in all cases, is electrolytically refined copper, so chosen for its excellent mechanical and electrical properties. The copper is imported in 250 lb coils of ¼-in.- or 5/16ths-in.-diameter rod, cleaned or 'pickled' in a dilute solution of sulphuric acid, drawn down to the required size, and finally annealed, or softened.

The drawing-down process is accomplished on two types of machine, the first of which,



Initial wire-drawing process, where ¼-in. or 5/16ths-in.-diameter copper rod is drawn down to 'feed wire'

through a series of tungsten carbide dies, reduces the rod to a suitable diameter for use as 'feed wire' to the second and smaller machine. This 'feed wire' diameter may range from 0.064 in. to 0.114 in., depending upon the required finished size and is, as yet, in the hard-drawn state.

In the second drawing-down operation, the reduction to final wire size is made, in this case, through a series of diamond dies; the wire is now annealed and finally wound on to hardened steel spools.

Some of the more common conductor sizes used are shown in tabulated form against the requirements.

Nominal diameter in.	Nominal weight lb/mile	Nominal breaking load of annealed wire lb	Standard resistance of plain annealed wire ohms/mile at 20°C	Minimum elongation without fracture per cent
0.0159	4.05	7.36	216.60	20
0.020	6.40	11.60	136.89	20
0.025	10.00	17.60	87.61	25
0.0355	20.16	35.43	43.46	25
0.040	25.57	45.00	34.22	25
0.050	40.00	70.40	21.90	30

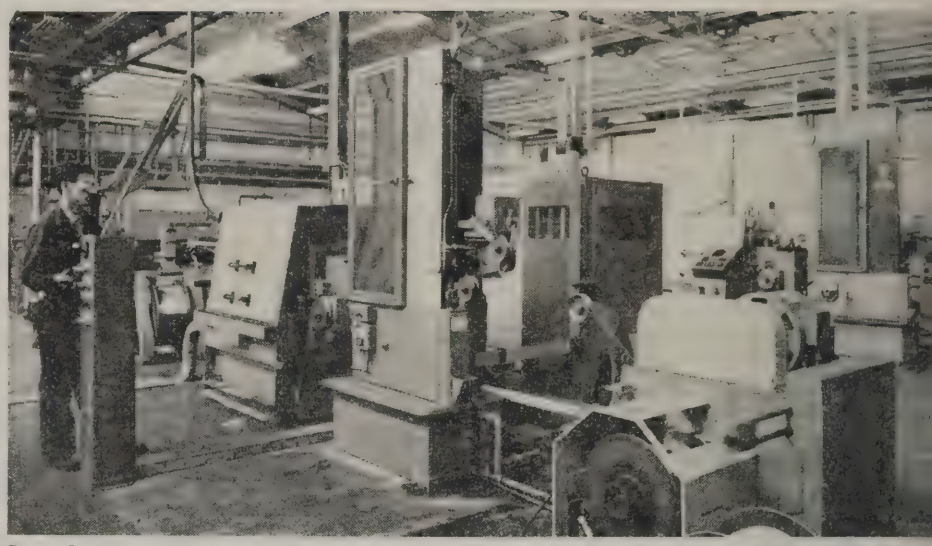
Reprinted from N.Z. Standards Bulletin March, 1965

The resistance values quoted in the table are derived from the basis of copper having a conductivity of 100 per cent, such copper being defined by the International Electrotechnical Commission as having a volume resistivity of 0.017241379 ohm-mm^2/m at 20°C. The permissible tolerance of the conductor diameters in the finished cable is ±0.0005 in., and internal standards control the allowance, which must be incorporated at the wire-drawing stage to ensure that further processing of the wire through the various manufacturing phases does not result in a conductor diameter outside the specified tolerance.

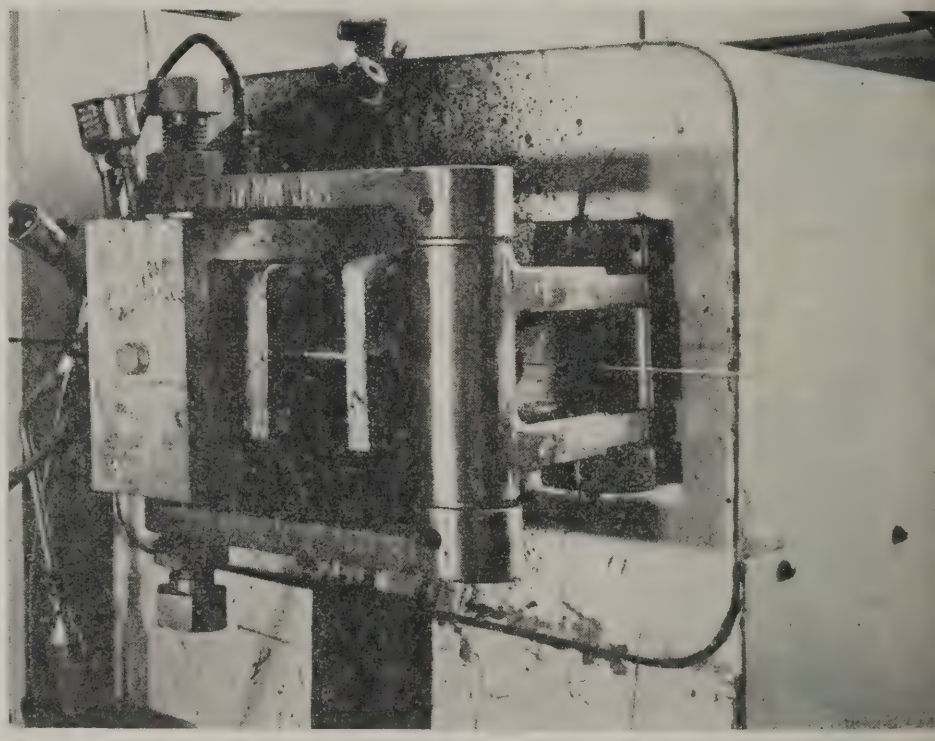
The conductor is now ready to be insulated, which insulation may comprise either plastic (polythene or P.V.C.) or paper.

Plastic insulation: Various grades of both polythene and P.V.C. are available, the choice of insulant and grade being determined by the desired properties of the finished cable in which the insulated conductors are used. In either case, compliance with the relevant standard specification ensures a consistent quality material for both mechanical and electrical properties. Insulation of the bare conductor is accomplished on a machine, known as an extruder, which extrudes the insulant in its molten state around the conductor, in the form of a concentric tube.

The plasticity and concentricity of the insulant around the conductor are maintained within narrow limits by electronic instruments during the extrusion process, and typical concentricity values are shown for three conductor sizes.



Second stage of wire drawing, where the 'feed wire' is drawn down to finished size and annealed

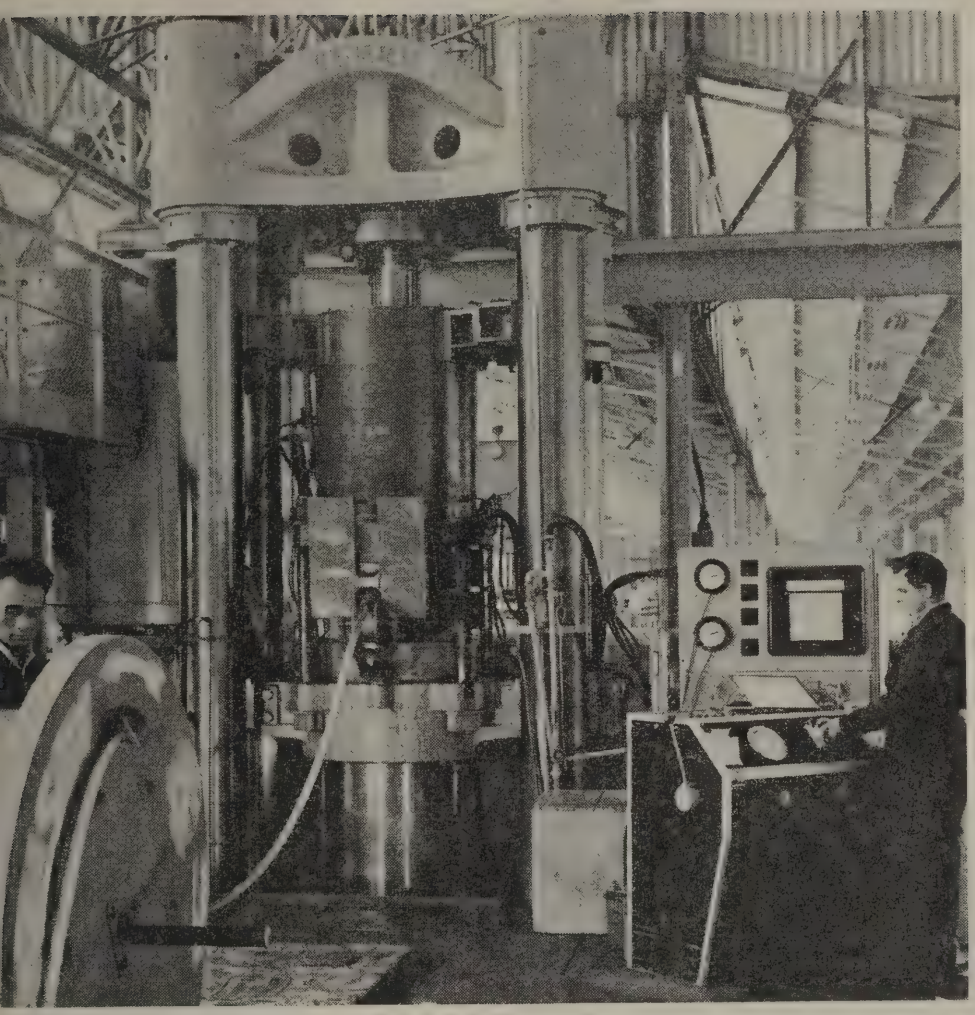


An insulating-type plastic extruder, showing the crosshead. Note the entry of the bare conductor at right of cross-head and its emergence as a plastic insulated conductor at the left

Conductor diameter in.	Thickness of insulant in.	Tolerance on thickness in.
0.020	0.008	0.001
0.025	0.010	0.0015
0.0355	0.012	0.002

For subsequent identification of any wire within the finished cable, colouring compound is incorporated at the extrusion stage, the respective shade of colour again being designated by standard specifications.

Specified conductor colours are now 'twinned' or twisted together, to a predetermined twist length, to form a 'pair', the required number of pairs are stranded together in concentric layers, or bunched, and finally an outer sheath of either polythene or P.V.C. is extruded over the cable 'core'. The sheathing extruder is a larger version of that used for insulating, and, in this case, after cooling and drying of the outer sheath, the cable is wound directly on to a wooden drum, preparatory to final test and dispatch.



Left: A paper insulated cable being sheathed with lead through one of the large presses.

Paper insulation: The paper used for insulating is imported in rolls approximately 300 lb in weight, width of 25 in., and thickness of 0.0025 in., 0.0035 in., and 0.005 in. Rigid specifications again control the quality of paper and limiting values applied under given sets of conditions to such properties as:

Weight per square metre
Thickness
Breaking strength
Elongation at break
Fibre constituents
Moisture penetration

The rolls of paper are processed through a machine which prints and slits the paper into predetermined widths varying between 3/16ths in. and $\frac{1}{2}$ in. Printing is essential for subsequent identification of a wire in a pair or quad and comprises one to four transverse lines, coloured either red or blue for quad-type cables, or red, blue, orange, or green for unit- or pair-type cables. The width and thickness of paper used are dependent upon the size of conductor to be insulated and upon relevant desired electrical properties of the finished cable, such insulation being a combination of paper and air.

The printed strip of paper is helically wound around the conductor and so selected in relation to the conductor size as to ensure adjacent overlap of adjacent wraps. The paper-to-air ratio, or 'density', is determined by an 'insulating polisher,' or small hardened steel die, through which the paper-wrapped conductor passes and which effectively closes the paper tube around the conductor to the specified diameter. Some idea of the importance placed on this polisher may be gauged from the fact that the allowable wear on bore diameter is restricted by internal standards to ±0.0005 in., when used on the higher quality quad conductors.

Unit-type cables. Two insulated 'singles' are now twisted together in a high-speed twinning machine, forming a 'pair', again to a specified twist length. The required number and types of pairs are then stranded in concentric layers to form either a cable or unit. The larger-sized cables are made up of units; for example, an 1800 pair cable would comprise 18 x 100 pair units, stranded together in three layers of two, six, and 10 such units, and finally wrapped with two overlapping papers.

After a preliminary test to ensure continuity, absence of short circuits, and correct numbering sequence of the pairs, the cable is thoroughly dried in one of six vacuum ovens, the drying cycle covering a duration of 16 hours at an average temperature of 220°F.

Final protection, in the case of duct cables, is effected by a continuously extruded sheath of lead around the cable, applied through a core and die arrangement, with the lead in a plastic state. The temperature of the lead is extremely critical and, to a large extent, determines the ultimate quality of the sheath. Consequently, the extrudate temperature is controlled electronically by a potentiometric-type instrument having an accuracy over the scale of ±0.25 per cent. Further protection, as required for directly buried cables, comprises a winding of either galvanised steel wires, or bitumenised steel tapes, sandwiched between two layers of bitumen-impregnated jute yarn.

Quad-type cables: A quad is formed by twisting, to a specified lay, four insulated 'singles' around a paper string, such that diametrically opposite wires form a pair. A whipping of coloured flax yarn is then applied, both to assist in maintaining the physical configuration of the quad and as a means of subsequently identifying the quad in a cable. Finally, the quad is passed through a 'quad polisher', which effectively closes the four wires to their specified diameter.

The predetermined length of twist is again an important consideration, particularly in quad-type cables, and the ratio of stranding lay to quad twist, known as the

new

A Solid-State 100-Mc Digital Frequency Meter for $1995

...with direct counting over the entire dc to 100-Mc Range

This is a complete digital frequency meter with features you'd expect to find only in much more expensive units. Adjustable input sensitivity and trigger-level control ensure maximum measurement accuracy with any waveform, from sine wave to random pulse train. In-line readout is bright and sharp — decimal point, units, and spill indication (when count exceeds register capacity) are presented automatically. The counter is easy to use; direct-counting methods, rather than heterodyning, make frequency measurement an automatic operation over the entire range. A second model, the Type 1144-AP, is available with data output for printer or D/A converter.

The Type 1144-A Digital Frequency Meter is a combination of two new instruments: a decade scaler and a 10-Mc counter. The Type 1156-A Decade Scaler divides the unknown frequency, providing an output signal whose frequency is exactly one-tenth the unknown frequency. The Type 1153-A Digital Frequency Meter measures the frequency of this signal and displays the value on a five-digit bank of indicators. Choice of four gate times allows eight-figure resolution at the low cost of a five-digit counter.

Since both the counter and the Decade Scaler are self-sufficient instruments, they can be used to advantage in other measurements — the scaler as a precision 10:1 frequency divider, the counter as a complete 10-Mc digital frequency meter.

A 500-Mc Frequency Meter with High Sensitivity and Selectivity

Sensitivity is better than 10 mV from 100 kc/s to 500 Mc/s, better than 100 mV from dc to 100 kc/s . . . choice of narrow-band or wide-band operation.

Type 1143-A Frequency Measuring Assembly, $3090, includes:

Type 1153-A 10-Mc Digital Frequency Meter,
Type 1133-A 500-Mc Frequency Converter,
time-base frequency multiplier, and all interconnecting cables.

INPUT: dc to 100 Mc/s

Sensitivity: (switch selected) 0.1, 0.2, 0.5, and 1.0 Volt, peak-to-peak at 50Ω, 1.0 Volt at 500Ω.

Maximum Input: 20 times sensitivity, or ½ watt, whichever is smaller.

Impedance: 50Ω or 500Ω (switch selected).

VSWR: 1.1 max at 100 Mc/s (50Ω).

Reflection: 10% max with 0.4ns step (50Ω).

ACCURACY: For 1153-A Digital Frequency Meter, ±1 count ±time-base accuracy.

TIME BASE:

Frequency: 100 kc/s from room temperature crystal oscillator — no warmup required.

Temperature Effects: less than 6 ppm, 0° to 50°C ambient.

Temperature Coefficient: ±0.1 ppm per °C, 20° to 30°C ambient.

Aging: Less than 0.1 ppm per week.

GATE: (Counting Times) 0.01 sec, 0.1 sec, 1.0 sec and 10. sec.

DISPLAY TIMES: 0.16 sec to 10.24 sec in binary sequence, plus "hold" position.

DATA OUTPUT: 10-line for each decade

PRICE: Type 1144-A 100-Mc Digital Frequency Meter . . . complete . . . $1995.
Type 1144-AP, same as above, but with data output . . . $2050.
Type 1153-A 10-Mc Digital Frequency Meter . . . $1495.
Type 1156-A Decade Scaler . . . $490.

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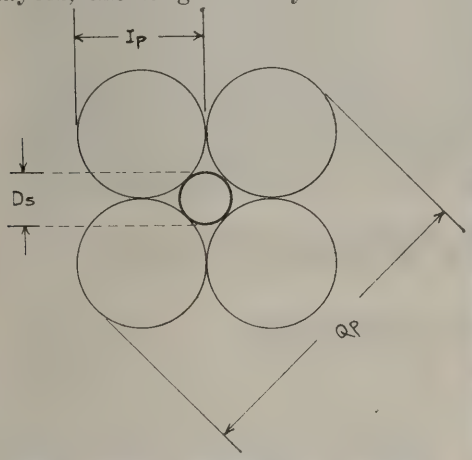
50 ANNIVERSARY

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

'specific torsion' of the quad, must be correct to specific limitations. Any deviation from these limitations results in high 'capacity unbalances' between circuits, causing 'crosstalk' or overhearing between subscribers on different circuits. It is further essential that the quad geometry be correct and this will be so, provided certain relationships are observed. For example, it may be readily shown from simple geometrical considerations that, with a given insulating polisher diameter (Ip), the diameter of the centre string (Ds) is given by Ds = 0.414 Ip, and the diameter of the quad polisher (Qp) by Qp = 2.414 Ip.

The required number of quads are now stranded in concentric layers, the length of lay and diameter over each layer again controlled by internal specifications relative to the type of cable under manufacture. The cable is then dried and sheathed, has additional protection applied if required, and is wound on to a wooden drum pending final test.



Quad formation showing four insulated conductors around a centre paper string.

The classification and end use of the cable determine the number of tests to which it is subjected, the higher-quality quad-type cable, for example, necessitating a more comprehensive set of tests than the unit type. Such tests encompass both mechanical and electrical properties, and basic tests applicable to all cable types follow.

Mechanical

- Pressure testing of sheath
- Diameter and elongation of conductor
- Mandrel test on insulated conductor.

Electrical

- Insulation resistance
- Mutual capacity
- Capacity unbalance
- Continuity and absence of 'shorts' on conductors
- Conductor resistance.

Whilst the manufacturer can and does go to great lengths to ensure quality consistency in his product, to what avail is this if the instruments used in measuring this quality do not in themselves conform to given sets of standards? Great care is taken therefore in the initial choice of such instruments to ensure that the required accuracy and sensitivity are sufficient and, that furthermore, they will remain so throughout the working life of the instrument.

In concluding this article, the author can only hope that some appreciation of the ramifications of telephone cable manufacture has been imparted to the reader and that the point has been made whereby the terms quality and standards are seen to be synonymous, as indeed the term quality in itself is meaningless unless gauged in relation to relevant standard specifications.

Principal standard specifications used

BS 174/181 Overhead line-wire materials (non-ferrous) for telegraph and telephone purposes.
BS 182/184 Galvanised iron and steel wire for telegraph and telephone purposes.
NZSS 7 Tests on thin metal sheet and strip.
BS 801 Lead and lead alloy sheaths of electric cables.
BS 1442 Galvanised mild steel wire for armouring cables.
NZSS 1409 P.V.C. insulation and sheath of electric cables.
NZSS 1470 Methods of testing plastics—Part 1: Effect of temperature.
BS 2782 Methods of testing plastics—Part 2: Electrical properties.
BS 3234 Polythene insulation and sheath of electric cables.
BS 2946 Diamond dies for wire drawing.
BS 443 Galvanised coatings on wire.

Below: A 300 pair 20 lb quad local type cable being prepared for 'final test'.

ENQUIRY CARD AD. 12

New Portable Speedservo

(fast, sensitive, simple, versatile)

New, high-speed, high-capability Portable Speedservo—another new generation "Graphline" instrument from Esterline Angus—designed to handle all your recording needs, tomorrow's as well as today's.

HIGH SPEED: $\frac{1}{8}$ second full scale response. Records 4 cycle signals without significant attenuation. SENSITIVE: 0-1 MV DC without jitter. Many higher ranges. Accuracy $\frac{1}{2}\%$. VERSATILE: Accommodates DC circuits with output impedance 100,000 ohms or less. Portable unit features sloped stainless steel writing surface. Chart tear-off bar. Full 6" wide 100' long chart. CONVENIENT: Dial 14 chart speeds from $\frac{3}{4}$ per hour to 6" per second. Input terminals, multi-range and feed selectors mounted at front for convenience. Hinged doors provide easy access to writing system and re-roll mechanism. LESS MAINTENANCE: Simple linear motion pen motor (unique shuttle type, not rotary); no strings, no pulleys. Zener reference voltage prevents hunting.

In addition to the new Speedservo, the radically new EA "Graphline" of rectilinear recorders include both single and two-channel DC Microammeters, DC Milliammeters, AC or DC Ammeters or Voltmeters, plus inkless and ink-type event recorders. Your inquiry is invited.

ESTERLINE ANGUS

Excellence in instrumentation for over 60 years

SOLE NEW ZEALAND AGENTS:

E. C. GOUGH LTD.

P.O. BOX 873 — PHONE 62-254 — CHRISTCHURCH

P.O. BOX 8150, Newton — PHONE 16-100 — AUCKLAND

ADMIRAL
23" Tv.
16K110
Vertical Chassis

IMPORTANT ALIGNMENT HINTS
(For all chassis models)

The following suggestions should be tried if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning 3rd IF transformer. To correct either of these conditions, the following alignment hints should be tried.

(a) Check the generator output leads to be certain that the unshielded portion (and especially the grounded lead) is as short as practicable.

(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible.

(c) The use of nine inch hexagonal alignment tool will permit adjustment without encountering "hand capacity" effects.

2. RECEIVER OVERLOADING WHEN CHECKING THE OVER-ALL RESPONSE CURVE: Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading of the last IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading, the following should be done:

(a) Be certain that the generator output attenuators are set for minimum output.

(b) Some generators have a built-in pad in the output cable. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.

I.F. ALIGNMENT

I.F. Signal Injection of Spot Frequency and Sweep Generators.

The preferred method is by means of a split can fitted over the V102 mixer tube envelope.

Note that slight detuning of A3 can occur when the I.F. injection sleeve is removed, and correction must be made for this checking the overall curve.

A3 must always be tuned close to the video carrier F., i.e. 38.9 - 39.0 Mc/s, providing maximum response at these frequencies.

If spotting and sweep generator output is very low, it may be necessary to connect I.F. input directly to tuner test point W, but wherever possible split mixer can injection should be employed. **Note:** If the curve deviates markedly from that illustrated in diagram the spot frequency alignment procedure should be repeated from A1 through to A7 once again.

It should be realised clearly that any significant deviation from the spot frequencies quoted may produce undesirable phase shift errors in the I.F. strip, even though a reasonable curve appearance may have been achieved.

Remember to.—

Use a non-metallic alignment tool.

Set Super Range Finder control fully to left (counter-clockwise).

Allow about 15 minutes for receiver and test equipment to warm up.

Use lowest DC scale on VTVM (negative polarity) through decoupling filter to point "V".

Employ the split tube can method of I.F. Signal Injection. Fit can over V102 to provide required coupling (see fig. 5). **Set Channel Selector to Channel 4**

Note: If split tube can injection cannot be employed, connect terminated generator lead to tuner test point W and set **Channel Selector to Channel 13.**

Follow I.F. Amplifier Alignment Procedure Chart.

IF RESPONSE CURVE CHECK
(using Sweep Generator and Oscilloscope)

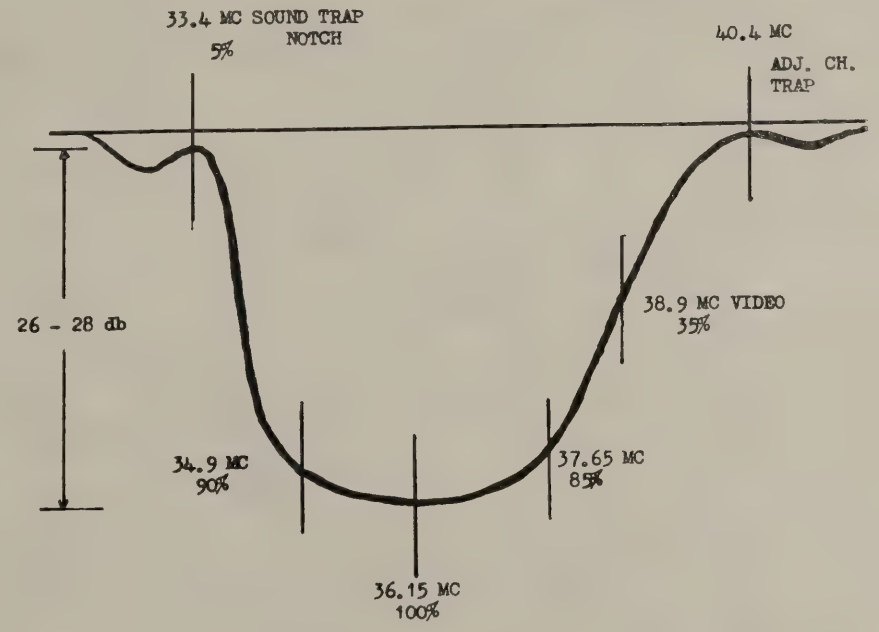
Receiver Controls and Bias Battery

Set Channel Selector on Channel 4.* Contrast control fully to the left. Connect negative of 3 volt bias supply to test point "T" (IF AGC), positive to chassis.

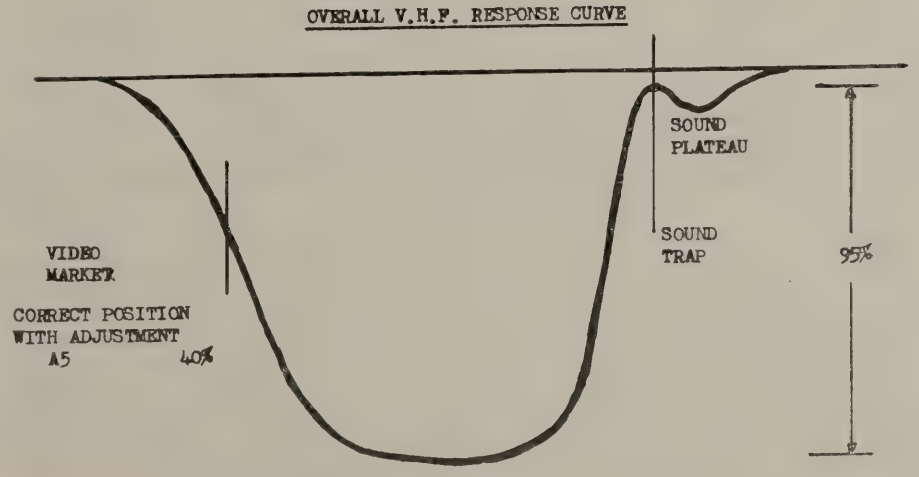
Sweep Generator

Connect high side to V102 mixer-osc. insulated tube shield see fig. 5. Connect low side to chassis near tube shield. Set sweep frequency to 37MC and sweep width approximately 7 MC.

IDEAL I.F. RESPONSE CURVE

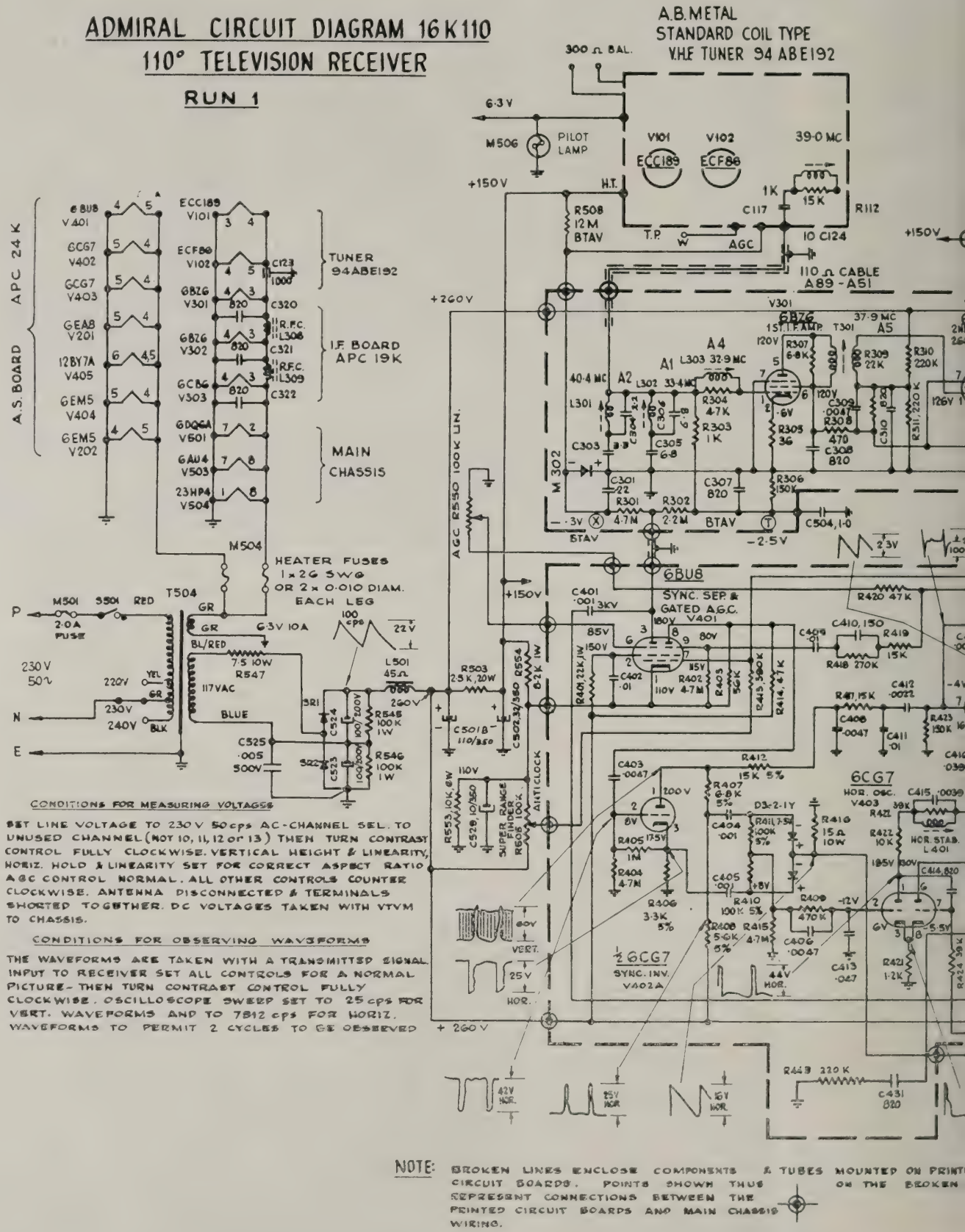


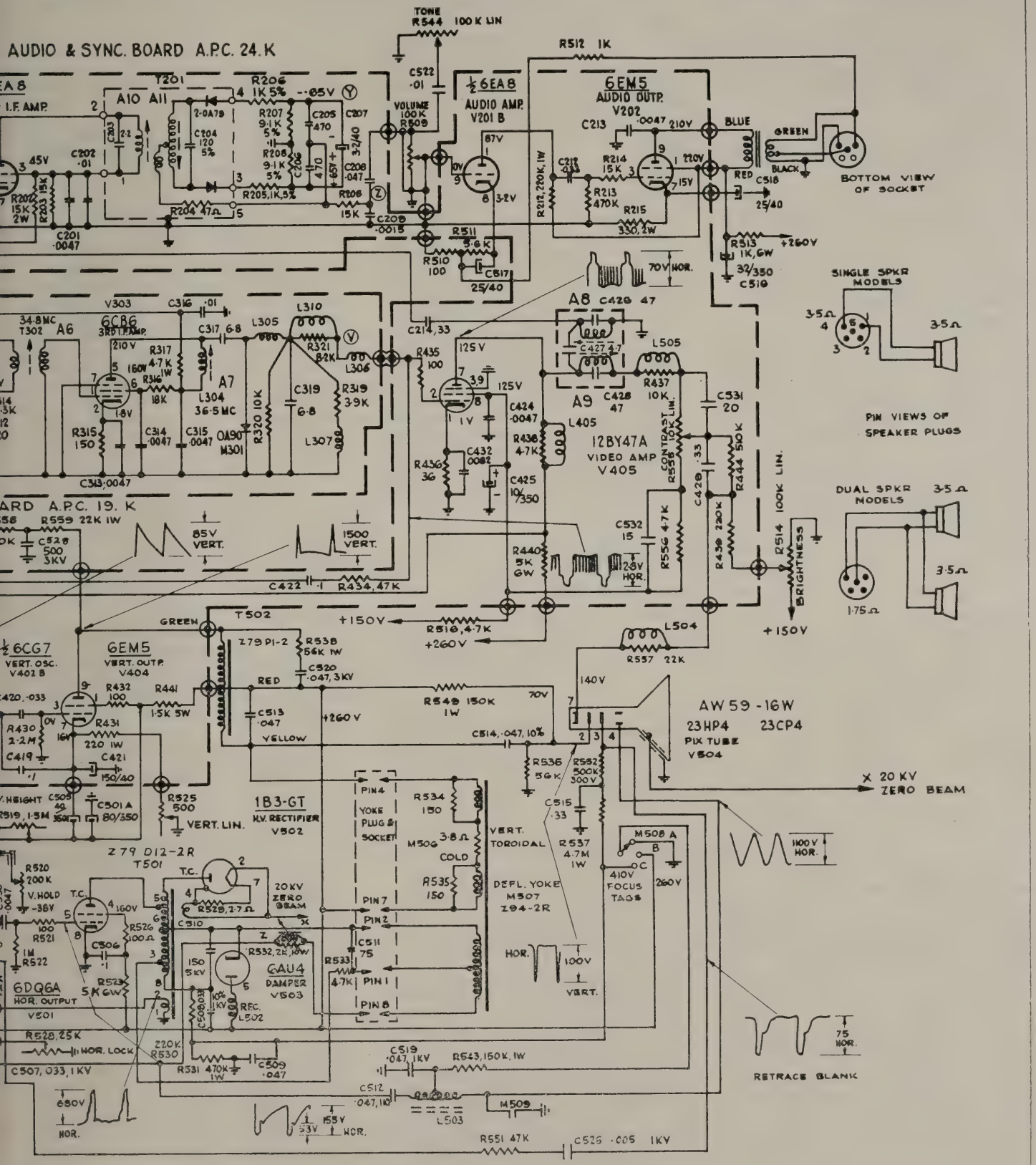
OVERALL V.H.F. RESPONSE CURVE



CORRECT TILT WITH ADJUSTMENT A7

ADMIRAL CIRCUIT DIAGRAM 16K110
110° TELEVISION RECEIVER
RUN 1





DRG Nº Z99-6

NOTE: For V405 read 12BY7A

IF RESPONSE CURVE CONTINUED

Marker Generator

If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis, Marker frequencies indicated on IF Response Curve.

Oscilloscope

Connect high side to test point "V" through decoupling filter.

Instructions

Check curve obtained against ideal response curve in fig. 7. Note tolerances on surve. Keep marker and sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch up with IF slugs as follows:— A5 or A7.

Slight touch up adjustments only should be required. If curve departs widely from ideal shown, **repeat Spot Frequency Alignment.**

A7 controls tilt of curve.

A5 affects location of video carrier on curve.

IMPORTANT: If curve changes shape with hand capacity, see section 1 of "Important Alignment Hints".

* If sweep generator is connected to Tuner test point W, **Channel Selector must be set to Channel 13.**

5·5 MC. SOUND I.F. AND TRAP ALIGNMENT (1)

Using television signal or signal generator and instruments.

Adjustment need be made on one channel only

It is preferable to use a TV signal rather than a signal generator for this alignment. However, if a TV signal is not available, a signal generator which has been checked against a crystal calibrator or other frequency standard may be used. Accuracy required is within one kilocycle.

* If a television signal is to be used, connect antenna, set Channel Selector to the strongest TV signal available and tune in a picture.

* If a signal generator is to be used, disconnect antenna and short terminals together. Connect high side of generator to junction of L306 and R435 through a 0.01 MF, capacitor, point V.

* Allow about 15 minutes for receiver and test equipment to warm up.

* Set Contrast control fully to the left (counter-clockwise).

* Use a NON-METALLIC alignment tool. Ratio Detector Transformer (T201) has hollow core slugs. Adjustments A10 and A11 can be made from the top of transformer if you use correct alignment tool, obtainable from Admiral distributor, Part No. 98A30 -12.

5·5 MC. SOUND I.F. AND TRAP ALIGNMENT (2)

Using television signal, no instruments.

Step	Signal Gen. Freq. (MC).	VTVM Connections	Instructions	Adjust
1	Tune in TV Signal or Set Signal Generator to exactly 5.5 MC.	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A8 and A10 maximum (keep reducing generator output to below 10mV.
2		High side to test point "Z"; common to chassis.	Use zero centre scale on VTVM, if available.	A11 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If off, repeat step 1.
3		Connect as per fig. 3.	Use lowest DC scale possible on VTVM.	A9 for minimum.

I.F. AMPLIFIER ALIGNMENT PROCEDURE CHART

Step	Signal Gen. Freq.	Adjust	Instructions
Important Before proceeding, be sure to check the signal Generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation. Sweep Generator characteristic must be known, and if output is not flat into resistive load, make due allowance when interpreting results.			
1	33.4 MC	A1 for minimum	If necessary, increase generator output and/or reduce bias to –1½ volts to obtain a definite indication on VTVM.
2	40.4 MC	A2 for minimum	
3	39.0	A3 for maximum	Tuner output.
4	32.9	A4 for maximum	
5	37.9	A5 for maximum	Use –3 volts bias. When adjusting, keep reducing generator output to prevent VTVM reading from exceeding 1.5 volts.
6	34.8	A6 for maximum	
7	36.5	A7 for maximum	
8			To ensure correct IF alignment make IF Response Curve Check with sweep generator.
9	Compare sweep curve with fig. 7.	If unsatisfactory, repeat alignment procedure steps 1 through 9.	
10	Tilt of curve may be adjusted by slight retouch of A7.		
11	Location of Video Carrier at correct 35%-40% level may be adjusted by slight retouch of A5.		

OVER-ALL VHF RESPONSE CURVE CHECK

Receiver Controls and Bias Supply

Set Super Range Finder control fully to left (counter-clockwise). Channel Selector on Channel it is desired to check. Connect negative of 3V. bias to test point "T" (IF AGC) and test point "X" (RF AGC), positive to chassis.

SWEEP GENERATOR, 300 ohm balanced output.

Connect to antenna terminals. Keep generator output as low as possible to prevent overloading.

MARKER Generator

If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table.

Oscilloscope

Connect to point "V" through a decoupling filter.

Instructions

Compare the response curve obtained against the ideal curve shown in fig. 10.

Slight correction of A3 may be necessary to compensate for the removal of the split mixer can used for I.F. Signal injection, replacement by the normal tube can.

Adjust A3 for maximum Video Carrier response, i.e. tune to 38.9-39.0Mc/s. Video carrier marker should then appear at 40% amplitude point. To correct curve tilt, slight adjustment of A7 is permitted.

It should never be necessary to turn A7 slug more than one turn in either direction.

If this curve is satisfactory on the channel checked, all other channels should also be satisfactory, but due to tuner tilt tolerances, a compromise may be necessary from channel to channel. Compromise with A7 adjustment.

Note: The Video Carrier location points quoted refer to the position occupied when the Sound Carrier marker is located **exactly in the Sound Trap Notch Minimum.** This permits proper tuning tolerances for various signal comitions. For strong signals, fine tune for positions as quoted. For weak signals fine tune for Video Carrier location at about 60%, with Sound Carrier on Sound plateau curve maxima.

IMPORTANT

When sweep output is reduced, response curve amplitude on scope should also decrease, but curve should remain the same shape. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change.

SERVICEMAN'S COLUMN

Conducted by J. Whitley Stokes

It seems that a sure-fire formula for attracting reader interest in any serviceman's column is to provide a description of any unusual or off-beat faults encountered in the course of the daily grind. Often it will be found that such faults are to be found in the simplest piece of equipment such as the ubiquitous 5 valve mantel radio and this month's story concerns such a receiver.

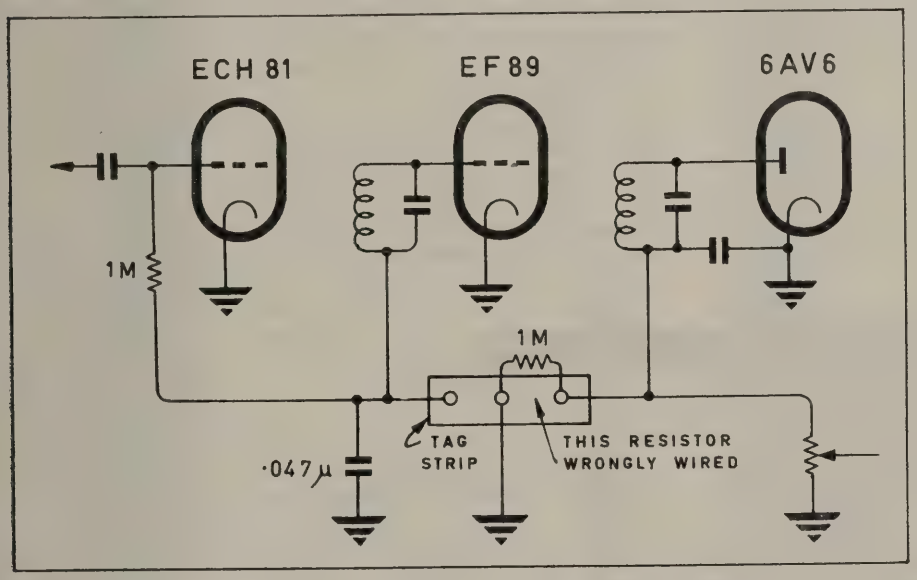
The set in question was received in a non-operating condition and was reported by its owner as having performed satisfactorily up to the time it stopped. As is commonly found nowadays the owner possessed both a radiogram and TV in addition, so the point arose that if the repairs were going to be too expensive the job would not be done. In other words "How much will it cost?"

Fortunately the particular set was one that had been sold in large quantities and thus was quite familiar. A quick check confirmed the initial guess that the output transformer was o/c, so I took a chance on it and hoped nothing else was wrong, but little did I know what I was letting myself in for. After giving a quotation and receiving a go ahead from the owner I proceeded to replace the defective transformer and upon doing so was able to get the set functioning again.

However when a local station was tuned in it was obvious that something was amiss as considerable distortion was evident. This pointed to trouble in the AVC circuit as the symptom wasn't apparent on distant stations, and a check showed no AVC voltage on either mixer or IF stage. As there was no short to earth on the AVC line and no leakage from B + to IF grid a check was made of the wiring and it was soon found that there was no circuit back to the AVC take-off point — that is the mixer and RF grids were just floating.

My first thought was, quite naturally, that someone had been "Having a Go", but a careful inspection of the wiring revealed that this was not the case. This particular model used simple AVC taken directly through a 1 Meg isolating resistor from the diode load which in this case was the volume control.

This 1 meg AVC filter resistor had been wrongly wired at the factory, the low end being soldered to an earth lug on the tag-strip instead of to the lug which connected to the AVC line. This then was the cause of the missing AVC volts and it was the work of a moment to clip the low end of the resistor and resolder it to the correct lug. After this was done the thought occurred — How was it that the owner had been able to use the set in this condition?



The answer to this was to be found in the fact that the aerial lead had been tightly coiled up and pushed in between the side of the chassis and the cabinet. As a result the signal pickup even on local stations was just sufficiently low to prevent overloading of the I.F. stage. As soon as the aerial lead was untangled and left lying on the bench overloading was immediately apparent. Perhaps the most surprising aspect was that the ECH81 and EF89 valves showed no ill effects as a result of being run with open grid circuits for several years.

At this point I had decided that I was going to come out alright on my original quote, but more was in store! When the volume was turned up even slightly quite severe microphony was present between the speaker and ganged condenser. This is a seldom encountered condition nowadays but occasionally occurs in certain makes of gangs where the stator plates are soldered to metal capped ceramic locating bushes. In such cases a fracture of the ceramic insulator can occur due to rough handling. A close inspection of the gang revealed that this was the cause of the microphony, but what to do?

The fitting of a new gang would end any chance of making a profit on the job so after thinking it over I decided to "repair" the condenser. This was done by carefully wedging two suitably sized strips of insulating material between each side of the stator bracket and the frame of condenser and then cementing the strips in position. The job was left to dry overnight and next day was found to be 100% successful. Not the sort of procedure to be used in normal circumstances, of course, but one suited to the occasion where low cost was of prime importance.

As we haven't had one for many a long day, I trust younger readers will bear with me if I include another "Old Timer's Puzzle Corner".

Question — Which manufacturer of an early (1928) A.C. operated domestic broadcast receiver used type 201A valves in all stages except the output?

If your answer was "several", score full marks.

Second Question — What manufacturer used the same line-up but with this revolutionary difference — the 201A filaments were supplied by a 3Mc R.F. power oscillator?

Clues — this manufacturer was already well known as the maker of battery chargers and A & B eliminators using wet electroylic rectifiers. To anyone having access to the old Rider's Troubleshooters Manuals the answer will be found on P. 128 (early).

To my knowledge this was the first and only occasion such an unusual procedure has been for such a purpose. About 10 years later the idea was resurrected by some makers of 16mm. sound on film projectors and used to light the filament of the exciter lamp. At that time the reason for adopting this method was that due to the cost and bulk of low voltage rectifiers and filter systems needed for providing D.C., it was simpler and cheaper to use R.F. In this case the frequency was usually around 100 KC though.

More recently we have seen extensions of the idea used to provide the high voltage D.C. supply for early small screen TV receivers, the R.F. being connected to D.C. by voltage multiplying rectifier circuits. Readers may remember too that the R. & E. Adaptascope of a couple of years back also utilised an R.F. oscillator to provide the E.H.T. supply for the cathode ray tube.

ENQUIRY CARD AD. 14

SQ *Special Quality tubes for industrial equipment*

Latest frame-grid technique betters HF performance

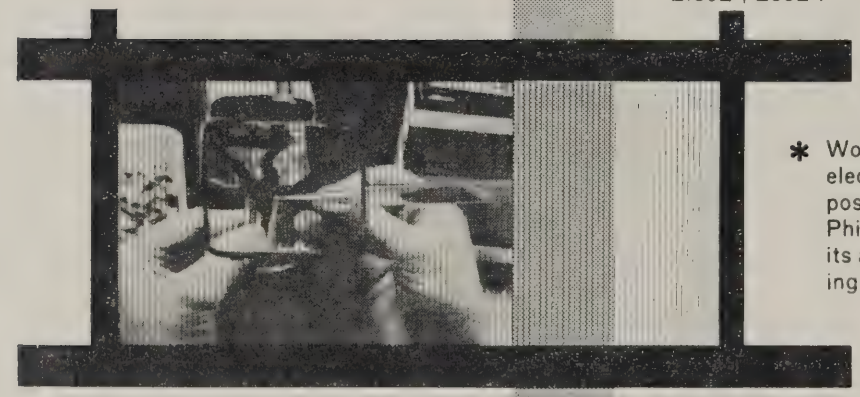
The use of electron tubes in industry is expanding from day to day. New applications and improvements in existing applications more than ever require utmost reliability. Therefore Philips developed the Special Quality series.

In the field of HF-applications, favourable characteristics are also of great importance. Philips therefore elaborated and perfected the frame-grid technique (more windings with only 10, 8 or even 5 micron thin wire!), realising:

- higher mutual conductance
- less microphony
- smaller spread in characteristics
- life-long stability

The application of the frame-grid technique in SQ-tubes realises a valuable series of tubes for almost any industrial HF application:
E88CC, E188CC, E180F, E186F, E810F*, E130L*, E55L*.

*dual frame-grid



Assembling the tube systems in precision jigs

✱ Worldwide know-how of electronics at your disposal. Contact the Philips organisation for its application engineering service.

	max. anode dissipation W	anode voltage V	anode current mA	amplification factor	mutual conductance mA/V
E88CC(6922)	1·65	100	15	33	12·5
E188CC(7308)	1·65	100	15	33	12·5
E180F(6688)	3	190	13	50	16·5
E186F(7737)	3	190	13	53	16·5
E810F(7788)	5	135	35	57	50
E130L(7534)	2·75	250	100	6·5	25
E55L	10	140	50	30	45

PHILIPS

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MINIWATT

NUCLEUS OF INDUSTRIAL ELECTRONICS

LISTENING POST

by michael lawrence

RADIO NEW ZEALAND

To allow for seasonal changes in reception conditions, Radio New Zealand, like most other broadcasting organisations, will be introducing a Spring frequency schedule on 5 September, which will be in force until 6 November. Details of this schedule are:—

To Pacific Islands: 1700 - 1945, 6,080 and 9,540; 2000 - 0545, 15,280; 0600 - 0845, 6,080 and 9,540. 9,540 closes at 0800 on Sundays only.

To Australia: 2000 - 2230, 9,540; 2245 - 0545, 15,110; 0900 - 1145, 6,080 and 9,540.

To Antarctica: (Sundays only) 0815 - 0845, 6,080.

HOLLAND

The following is part of the tentative schedule of Radio Nederland, effective from September 5th. There should be little change, if any, between this and the final schedule:—

Sundays: 0130 - 0150 English to Australia and N.Z. on 11,730 and 9,525; 0530 - 0550, English to Australia and N.Z. on 11,730, 9,715, 9,525 and 6,025; 0600 - 0720, Dutch to N.Z. on 11,730 and 9,525; 0600 - 0720, the "Happy Station" programme to N.Z. on 9,715 and 6,025; 0730 - 0850, Dutch to Australia on 11,730 and 9,525; 0730 - 0850, the "Happy Station" programme to Australia and Japan on 9,715 and 6,025; 0900 - 1020, Dutch to Australia and Asia on 21,480 and 15,445; 1030 - 1050, English to Asia and Europe on 15,425 and 9,525; 1400 - 1520, the "Happy Station" programme to South Asia on 17,830, 15,425 and 9,625.

Weekdays: 0600 - 0720 Dutch to N.Z. on 11,730 9,525 and 6,085; 0700 - 0750, English to Australia and N.Z. on 9,715, 6,025 and 15,445; 0730 - 0850, Dutch to Australia on 11,730, 9,525 and 9,560; 1100 - 1220 and 1230 - 1350, Dutch to South East Asia on 21,570 and 15,425; 1400 - 1450, English to South Asia on 17,830, 15,425 and 9,625.

A brief look at the tentative schedule which becomes effective on November 7th shows that the 0130 - 0150 transmission to Australia and N.Z. has been eliminated and the weekday English transmission to this area has been retimed to 0730 - 0820. However, fuller details of this schedule will be made available at a later date.

OTHER STATION NEWS IN BRIEF

NORWAY: The programme for Norwegians abroad from Radio Norway at 0745 - 0815 has been heard on 15,175 with a weak signal and slight interference from a teletype transmission. The other advertised channel of 11,850 could not be heard. Although the programme is in Norwegian, a request in the English language is made for reception reports just before the close of the transmission. The transmission at 1100 can be heard on 11,850, 15,175 and 17,825. The last frequency is the only one which is free from interference.

All frequencies are given in kilocycles and times in GMT.

SINGAPORE: The frequency of 5,052 which was formerly used by Radio Malaysia Sarawak can now be heard carrying English programmes from Radio Malaysia Singapore from as early as 0930. The signal strength at this time is low and the channel suffers severe interference but a big improvement is noticed by about 1100. This service broadcasts commercials, and news bulletins can be heard at 1100, 1400 and 1530. The transmission closes at 1630 with the announcement that the station will be on the air again at 6 a.m. local time on 5,052 and 11,940. This latter frequency was heard to close at 0130 but was on the air again around 0600.

TAIWAN: The Voice of Free China broadcasts the "Dragon Show" in English from 1130 - 1200 on 11,825 (good) 9,685 and 7,130. From 1200 - 1300 programmes on these frequencies are in Malayan and Mandarin.

SWEDEN: Radio Sweden broadcasts from 1230 - 1345 on 15,195 and 17,845. The 15 Mc/s outlet provides the best reception.

CZECHOSLOVAKIA: The English transmission to North America from Radio Prague is broadcast at 0100 and 0330 on 5,930, 7,120, 7,345, 9,795 and 11,990. At 0800, 9,505, 15,235, 15,285 and 21,450 are beamed to Australia and N.Z. while 6,055 is beamed towards Europe.

SPAIN: The Spanish National Radio in Madrid beams its English transmissions to the U.S.A. at 0100 - 0145, 0200 - 0245 and 0300 - 0345 on 9,360 and 6,130.

PORTUGAL: The Voice of the West can be heard with good signals in the English transmissions at 0200 - 0245 and 0345 - 0430 on 6,185 and 6,025.

NORTH KOREA: Radio Pyongyang broadcasts in English from 0400 to 0455 on 14,520 and 15,520. The 14 Mc/s frequency is poor because of interference from a teleprinter signal but the 15 Mc/s outlet is fairly good. After 0500 the programme on these frequencies is in an oriental language.

DENMARK: The 2115 - 2145 broadcast in the Danish language to Danish ships is received much better than the same broadcast at 0630. The frequency for this transmission is 15,165.

POLAND: Radio Warsaw opens a transmission at 0500 with a strong signal on 6,135. The programme is in foreign language.

JAPAN: The Far East Network at Tokyo has been heard around 1100 with a weak signal on 6,155. Their other channel of 11,750 at this time is heavily interfered with by the BBC Far Eastern Station on the same frequency, however, at 0600 the FEN can be heard on this channel. 3,910 provides quite good reception about 1400.

U.S.S.R.: Radio Tashkent broadcasts in English at 1200 - 1230 and 1400 - 1430 on 9,600 and 11,925.

INDIA: 15 minutes of local news in English can be heard at 1530 from All India Radio on the following frequencies:— 3,295, 3,925, 4,760, 4,962, 4,920, 5,995, 6,140, 9,615, 10,335, 3,268, 4,990 and 3,355.

PAKISTAN: English news from Radio Pakistan at 0215 is at poor strength on 9,645 and 11,885. The news bulletin is preceded by a programme in Urdu.

—Continued on page 35

N.Z.I.E. Annual Meeting

SUPPORT FOR SUGGESTED NEW RESEARCH BODY

Strong support for a research and development organisation, to be set up and operated by the electronics industry for its common use, was expressed at a symposium "The Development of Electronics in New Zealand", held by the Wellington Branch of the New Zealand Electronics Institute on Saturday, July 10. While many of those present asked for Government support by local buying, others urged the industry to stand on its own feet and look forward and find its own individual lines for development.

Mr L. Fuller, managing director of E.D.A.C., presented the view of the industry. He referred to the saving of overseas exchange, and employment, offered by local industry, though a local product often had a higher price than overseas goods. He considered that the present standard of living indicated that a reasonable balance had been set in New Zealand. To earn income from exports was a major responsibility of secondary industry. To achieve this, there had to be careful selection of suitable industries, more efficient production methods, and improved technical training.

Reviewing the history of the electronics industry in New Zealand, Mr Fuller said the industry had concentrated on the domestic market, except during the war when 100,000 radiotelephone sets had been exported. In 1964 160,000 television sets had been produced. Most of the components of these had been produced locally. Some 3,000 radio telephone sets were produced. A wide range of products for industrial electronics had been produced, but this at present was in embryo.

In the future, Mr Fuller saw the need for industrial electronics to be developed to allow the industry to continue and expand, and to stop the "brain drain." This, he considered, needed wholehearted government support. He quoted the high protection given the Australian electronics industry, and the policy in that country of Government departments buying locally.

"In such an environment," said Mr Fuller, "it will be possible to develop "Brains intensive" products for export, rather than export the brains themselves."

Basically, the industry in New Zealand is built around entertainment, contended Mr E. W. de Lisle, a senior Post Office engineer, in presenting the user's view. Here the industry had complete protection, but he suggested that the "know how" came from overseas. He referred to earlier work when much Post Office radio equipment had been locally made. New Zealand could not afford to rely on overseas "know how", as technological captivity could be as great a hindrance to industrial development as economic captivity. Industry must give greater attention to research and development, to expand.

Quality, considered Mr de Lisle, is a first requirement, and he praised the work of the Consumer Council. Reliability went with quality, and manufacturers should beware of the temptation to use second-grade components to reduce price. "There is always someone who will manufacture an article a little cheaper and a little worse, and the consumer who considers price alone is this man's lawful prey," he said.

"A basic requirement is that delivery promises should be adhered to," continued Mr de Lisle, saying that he had had experience of this in Government contracts. There must be an efficient after-sales service. He considered that the industry must pay particular attention to training. Government training had been developed to meet its own needs, and not to provide a pool of skilled staff for industry. The industry should train more sales engineers.

Mr de Lisle suggested that as the industry could not hope to compete with the main lines of overseas industry, it should conduct a survey to pick on some lines where there is not much competition. He did not think that research could continue on its small scale, fragmented present lines, and advocated an efficient research and development organisation. He praised the Institute for focussing attention on the need for industry to consider where it is going, by holding the symposium.

"Electronics in New Zealand has been one of our 'spectacular growth' industries," said Mr G. L. Easterbrook Smith, of the Industries and Commerce Department. "Exchange has been saved, and

useful technologies have been brought to New Zealand." He thought that the industry should develop specialised lines to suit New Zealand, and should be collectively organised to do this. An efficient industry should be protected to allow it to develop. Quality must not be lower than imported articles, and development should keep up with overseas. A proportion of television profits should be ploughed back into the industry, he considered, as was done in Australia. Companies should accept a period of lower profits while development proceeded. He reviewed tax concessions available for successful exporters, and suggested that exporters should explore export insurance. He described the electronics industry as a "spectacular growth" industry, and promised that his department would do all it could to help the industry.

Comment and questions from the floor were led by Sir Ernest Marsden. "We are too timid in this job," he said. "We are thinking of the last ten years and not the next ten." He pointed out that New Zealand had exported £500,000 of electronic equipment in 1944, of very high quality. "The consumer doesn't know what he wants," he continued. Three good electronics men could go into any industry and effect great improvements by introducing electronics to it. "I want electronics in each and every industry in New Zealand, some real development, better secondary schools, our sights set higher in the future, and more reliance on brians and work and less on committees," he concluded.

Mr L. W. Harrison (EDAC) led the plea for aid to the industry. He thought of the industry as being at the crossroads. Should it go to professional electronics (to service industry)? How? Government departments, he suggested, could give help by buying only from local industry, paying higher if need be, and by requiring industry also to buy locally.

Mr A. Durham (EDAC), said that Mr de Lisle had suggested avenues for industry, such as closed circuit TV. Did the Post Office provide TV cable circuits? Mr de Lisle indicated that it would. Mr Durham continued, suggesting payroll tax as in Australia, and asked if the "local price" factor that Industries and Commerce considered in gauging if protection was warranted was pro rata (assessed on comparative sizes of local and overseas industries) or arbitrary?

Mr Easterbrook Smith replied that each case was decided on its merits, and pointed out that if Government supported local industry, it could not buy all it wanted. He suggested that the industry must create the climate of opinion as to why it must be supported. To get this firm base the industry would need to make a combined approach to the Government to show that it must spend more so that it could diversify.

Mr C. W. Heyward, Engineer-in-Chief of the Post Office, pointed out practical difficulties of his department's buying locally. The Post Office had a system — he likened it to a printed circuit, 100,000 square miles in area, changing daily, yet daily growing. Any equipment installed today must be compatible with that installed five or more years ago. Equipment could not be installed on speculation.

Complacent reliance on Government support was attacked by Mr C. H. Turner, Chief Telecommunications Engineer of the Forest Service. "I suggest a motto for New Zealand," he said: " 'Not to worry, the Government will look after us!' But the industry must stand on it feet." He suggested that the industry should look to where it could help the country most, and that was with the labour shortage. Electronics could supply specialised equipment to meet this need. He thought that no materials engineering was possible in New Zealand, very little component engineering could be achieved, but that equipment engineering was a large part of the local industry and systems engineering exclusively so.

The high cost of preparing quotes for government contracts was referred to by Mr Martin Kimble (Collier and Beale), who suggested specialisation as television and telecommunications, for example, do not mix. He referred to a certain brand of oscilloscope he had seen in every laboratory overseas, and suggested that New Zealand should find a similar speciality.

"Wages are low in New Zealand," said Mr W. H. Ward, of the D.S.I.R. "Labour costs may be high — this is not to the credit of the engineers concerned." He said that New Zealand electronic equipment in the Antartic was expected to work better than its foreign counterpart — and did so. It had been produced by the electronics designers, not the users. He saw this century as the one where electronics would come to the aid of industry, as science saved agriculture in the 18th century — but it had not yet come about.

Another speaker suggested that New Zealand being an agricultural country, electronic development should concentrate on agriculture, and pointed to his own success in establishing a business making electronic instruments for scientific measurements in agricultural research. Mr B. S. Furby, chairman of the Wellington Branch of the Electronics Institute, pointed out that the industry was not giving users proper service where it employed non-technical salesmen who could not evaluate the customers' requirements. This view was endorsed by Wing Commander J. W. Todd, in expressing a vote of thanks to the speakers.

Mr J. E. A. Nixon (Victoria University) considered that the man with brains was not appreciated in New Zealand. "He feels that he is not equal enough." For this reason, many graduates went overseas, and industry should create a climate which would encourage creative and imaginative research.

Summing up, Mr W. S. Strong, chairman of the symposium, considered that electronics had established itself in New Zealand, but there was a need for more public awareness of what electronics was capable of, and a need to employ more brains. He considered that there must be more liaison between users and the industry, and a need for more research and development, possibly by the industry creating a common establishment.

ENQUIRY CARD AD. 15

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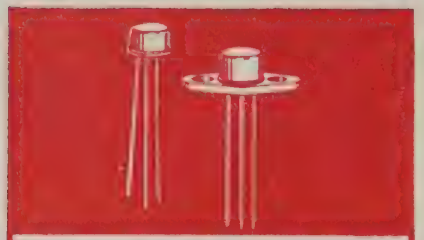

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VR.26

TAPE TOPICS

This article concludes our series on tape topics. It is hoped that some of the problems met by readers have been answered.

Information is sought in splicing magnetic tapes, and the correct method of making the joint.

In order to simplify the technique of cutting and splicing the tape, a number of manufacturers have produced splicers and editing blocks. Some of these are available from the various firms and shops which handle tape recording accessories.

A good splice is as easy to make as a bad one. The object of the exercise is to make the splice as permanent as possible, whilst producing the least interference and noise as the splice passes the heads. All that is really needed to make good splices, is a non-magnetic sharp cutting edge, a non-magnetic block to cut on, and some ½ inch splicing tape. A small strip of hardboard makes a good splicing strip, and one of the newer stainless-steel razor blades is ideal for cutting. If a steel cutting edge is used, any magnetic field present in the steel will be transferred to the oxide on the tape and produce an audible noise where the joint passes the heads. Accordingly if a steel blade is ever used it must be demagnetised. To join two pieces of tape, overlap the ends about ¾ inch, making sure that the tape is accurately aligned along its axis. Cut the tape at an angle of 30 degrees to the sides — cutting both tapes together. If a splice joint is made at right angles to the tape sides, the joint in time becomes stretched apart slightly, creating a gap in the tape. If the diagonal cut stretches apart slightly, there will always be some part of the tape passing the head at any time, and very little signal will be lost.

After the cut, clear away the short ends, and again ensure that the tape is correctly aligned when both cut ends are butted together. Holding the ends in contact press a short length of splicing tape on to the shiny side of both pieces. Do not put the splicing tape on the matt or oxide side, as this lies against the heads. The splicing tape should be applied so that the sides of the splicing material are parallel with the cut, i.e., the edge of the tape lies at an angle of about 30 degrees to the splicing strip. Trim off the surplus splicing material along the edges of the tape using the corner of the razor blade, cutting in towards the centre of the tape, and just take the edge of the tape away in a slightly convex shaped cut. If the tape is for use with a quarter track recording system be very careful, otherwise some of the two outside tracks may be removed. In all cases it is essential that no parts of the splicing material extend beyond the edge of the tape, otherwise these protrusions may cause the tape to catch or jump in the guides.

Press the splice firmly with the flat of the blade or with the thumb-nail to remove any air bubbles occluded under the joint. Check that the tape now lies straight and true and that there is no gap, or overlap between the cut ends. Finally dust the splice with French chalk on both sides to reduce any chance of sticking.

Do not under any condition use ordinary adhesive tape as splicing tape. It generally has the wrong type of adhesive, and this often will ooze out from under the splice after the joint has been wound back onto the reel, and may stick to adjacent layers. Furthermore some of this adhesive will probably come off on the heads, causing further trouble with a build up of dirt on the surface of the heads.

Finally, it is a good idea only to splice together tape of the same make, and kind. For instance, do not splice some long-play tape made by "A" on to some standard play tape made by "B".

The next and rather involved question we will attempt to deal with covers the Bias and Erase Oscillator; how to check whether it is operating and performing correctly, etc.

Deterioration in the operating condition of the bias oscillator can cause a number of faults in the tape recorder's performance. For instance the following faults can be often caused by the incorrect operation of the oscillator.

(1) Low output at normal recording levels; (2) Excessive distortion. (3) Loss of treble response. (4) Excessive treble response. (5) High noise level produced by recording. (6) Erase head not giving complete erasure.

The purpose of the bias oscillator is to (A) provide a high frequency bias current through the record head, thereby increasing the amount of signal which can be recorded on the tape and (B) energise the erase head and produce sufficient field to create a magnetic disturbance adequate to destroy the recorded programme.

Dealing first with (A). The value of the bias current fed to the record head, in some instruments is quite critical and should be kept as close to the manufacturer's specifications as possible. If bias current is higher than recommended, then the distortion on the recording may be reduced, but there will be a lack of treble response. On the other hand, if the bias current is lower than recommended, the treble response will be improved but accompanied by an increase in distortion.

In the case of (B), small variations of voltage across or current through the erase head do not cause any serious problems. However, if the winding current drops below 60-70% of its correct value, imperfect erasure may result.

Checking the Bias and Erase Current

The A.C. current flowing in the record and erase heads can be checked by measuring the voltage across these heads and comparing this with the voltage specified in the service manual. However, this technique may lack the desired accuracy because of a number of inter-dependant variables. The bias current/voltage ratio depends on the impedance of the heads. This, in turn varies with the oscillator frequency, and also with differing inductance from one head to another of the same brand and type. A preferable method is to measure the voltage across a resistor placed in series with the earth side of the windings in the heads. Use a value which is low, compared with the stated impedance of the heads, but not too low as to introduce significant errors, also use a precision resistor, preferably of 1% tolerance. A simple application of Ohms law will produce the answer to the value of current through the head.

In some recorders having metering facilities, one switch position is used to monitor the correct bias current. Usually, the meter is connected via a variable calibrating resistor, which is set at the factory. If this has been altered, or changed in value, the metering circuit must be checked and set up to the correct value after the correct operating current conditions for the heads have been established.

Another point worth remembering is that the oscillator current, in many cases, is fed to the record and erase heads via coupling capacitors. The value of these capacitors is usually chosen to determine the amount of current passing through the heads. Any major change in the value of these capacitors can upset the system, particularly in the case of the record head.

Oscillator Frequency and Waveform

To avoid noticeable beats occurring between the bias frequency and harmonics of the upper audio frequencies being recorded, the oscillator frequency should be at least four to five times the highest audio frequency that the tape deck is capable of recording. This dictates a bias frequency of 50kc/s or higher.

On the other hand, if the oscillator frequency is too high, there is an increased impedance to current flowing through the heads — due to the self inductance of the windings. The reduction of reactance of the self-capacitance of the windings causes also an increasing proportion of the current to be bypassed around the head windings. These two conditions result in a decrease in current through the heads, with attendant poor performance.

The frequency of the oscillator can be checked using an oscilloscope with

ENQUIRY CARD AD. 16

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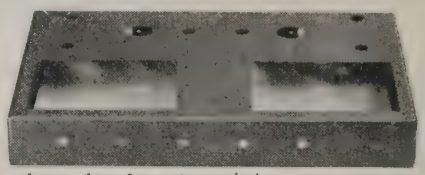

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the signal fed from the bias oscillator to the Y amplifier. Be careful of overload if the oscilloscope does not have a wide range of attenuator and the signal is taken from a high amplitude point in the circuit. If the oscilloscope is one with an accurately calibrated time base system, then the frequency of the tape oscillator can be read directly. In many cases the frequency calibration and synchronising stability of the oscilloscope time base is not accurate enough and another method should be used. This necessitates the use of a frequency calibrated audio oscillator fed into the X amplifier system of the oscilloscope, the time base turned off and Lissajou figures used for comparison of frequency. If the audio oscillator will tune across the expected range of the tape bias oscillator, then at one point a circular shaped pattern should appear and become nearly stationary on the screen as the test oscillator is adjusted carefully.

The pattern may not be purely circular because of distortion existing in the bias oscillator, even when the controls of the X and Y amplifiers have been adjusted correctly. However, if the bias oscillator is operating correctly, and producing a pure sine wave then the pattern will appear a true circle.

This brings us now to the point of bias oscillator distortion. If there is serious distortion of the oscillator voltage, this can produce an appreciable amount of unwanted background noise, in the absence of signal. As indicated before, the waveform of the A.C. voltage produced by the oscillator should be as close to a sine wave as possible. Either of the two methods suggested above for frequency comparison will give a good indication of the character of the waveform, providing that, in the second case, the audio oscillator used for comparison does itself produce a clean pure sine wave.

The presence of significant distortion can be due to a defective tube in the bias oscillator, or to resistors or capacitors which have changed value. Such a change is also likely to affect the frequency of the oscillator in some way.

In the case of recorders using a push-pull type of oscillator, lack of symmetry between the electrical characteristics of the two halves of the tube can cause such distortion. Another cause is excessive loading of the oscillator by the heads themselves — this can be checked as mentioned earlier, by noting the bias current through the heads.

Checking for Complete Erasure of Programme

To make a valid test on tape erasure use a brand new or a bulk erased tape. Run it through the deck recording a low frequency programme at the correct maximum level. Now rewind, and then record again over the same section, with no signal input and all gain controls off. Now rewind and play the tape back with the playback gain well advanced. There should be no sign of the recorded programme. The next question, one we have often been asked is, "How can I tell if I'm getting a satisfactory signal to noise ratio through my tape recorder?"

It would appear that some of these queries are conjured up in the minds of serious tape recording enthusiasts when they read the advertisements and various articles in the several journals devoted to tape recording techniques and interests. For the record too, they have occurred more than once in discussions between the technical editorial staff. We were somewhat disturbed at that time by the fact that there did not seem to be a satisfactory and indisputable method of measuring signal to noise ratio.

This problem stems from the fact that one must first define how loud the desired signal will be recorded, before comparison can be made between it and the residual noise. In the U. S., signal to noise ratio is apparently measured on the basis of a 400 cycle signal recorded at such a level that 3% harmonic distortion is generated.

This is accordingly a subject in which we are carrying out more investigations. So those who have made enquiries on this subject can be assured that we have not shelved their questions.

However, for those people who are not vitally interested in absolute measurements but would still care to make an assessment of their system, a measurement of this type will require the use of an A.C. volt/millivoltmeter with a wide frequency range. This method, which takes into account the noise and hum in the amplifiers, hum picked up by the playback head, tape bias, noise resulting from bias distortion and imperfect erasure, is quite simple and is almost the same as we mentioned earlier for checking the erase system. Use a new or a bulk erased tape to start with and then record a signal in the frequency range 400 to 2000 c/s at a level which is well below overload point but near the top of the normal dynamic range of typical programme material. After recording for several minutes, rewind and play back the recorded signal, monitoring the output level across the speaker voice coil line with the A.C. voltmeter. Now rewind again, and run the tape through on "record" but with all volume controls turned off, and no programme or signal fed to any point. Rewind for the third time and play back the erased portion of the tape, monitoring again the resultant noise level, which should be in the "millivolts" region. We now can get a direct ratio of **Signal + noise** / **noise** in terms of a voltage ration, or — as it is more commonly expressed — in decibels. If any tone controls are present on the recorder these should be left in the "flat" position throughout the test.

The final query we have to discuss this month concerns the measurement of "wow" and "flutter". This is a difficult question to answer. Very few tape enthusiasts, or for that matter even average well equipped service laboratories have equipment which could measure small amounts of frequency variation over a short or long period, i.e., those which could come under the heading of "flutter" or "wow".

At certain frequencies, in the vicinity of 3000 c/s, the average human ear is quite sensitive to deviations from constant speed. The effect of the presence of "wow" is to give the note a quavering or sour effect, whilst flutter is manifest as a coarseness or roughness of the pitch.

There is a likelihood that an electronic frequency counter, set up to do repetetive measurements at say intervals of 0.1 sec. could be used as a check on "wow" and possibly flutter, but this is something we have not pursued, as very few audiophiles or tape enthusiasts will have access to such an instrument.

ENQUIRY CARD AD. 20

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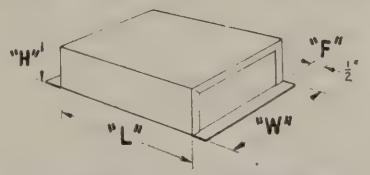

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ENQUIRY CARD AD. 21

Our Laboratory Reports on—

HEATH AA21 STEREO AMPLIFIER

This amplifier is one of the higher powered, more expensive, amplifiers from the Heathkit range of transistorised hi-fi gear. For an 8 ohm load each channel is rated 35 watts or 50 watts "music power" — music power being defined as the power at which distortion is ·7% at 1kc/s. The output power rating of amplifiers is a hot subject and we would prefer to rate this amplifier as 20 watts R.M.S. per channel at which rating the harmonic distortion over the range 100 c/s to 10 kc/s is never greater than ·9% (and that only at 10 kc/s).

The amplifier was received in built up condition so we have no way to report on construction time and techniques but inspection of the "works" indicated good use of printed circuits and no difficulty should be experienced in servicing.

Appearance is particularly pleasing; the front controls being slightly shrouded by a top overhang and sufficient chromium is used to satisfy the showy but not offend the unpretentious. The fascia plate is hinged so that preset controls can be adjusted from the front but all inputs are at the rear.

Performance

Two slightly annoying features appeared during our tests; noise and tone control dynamics. The measured noise was slightly higher than the manufacturer's figures but became annoying only with the volume control well advanced and during quiet periods. The range of the tone controls was as stated but both bass and treble controls gave maximum boost or cut only during the last 30° or so at each end — at least 10 dB of a range 15 dB (cut or boost) being in the end 30° of the control. The 30° ± about central position gave only 2 or 3 dB cut or boost and this was really not noticeable in live use.

Equalisation curves RIAA for 'phono and NAB for tape are used.

PERFORMANCE FIGURES

(1 channel)

Open circuit noise (no inputs) with all controls maximum.

PP 85 mV into 8 ohm load analysis of noise

50 c/s = 35 mV PP
100 c/s = 7 mV PP
150 c/s = 10 mV PP

remainder high frequency above 10 kc/s.

Shorting each input did not alter these noise figures.

(With controls minimum peak noise dropped to 2 mV).

Examination of the output on an oscilloscope showed a clear 50 c/s spike.

Noise under load

(a) 20 watts R.M.S. into 8 ohms
'Phono: — 40 dB
Tape: — 40 dB
Auxiliary: — 55 dB

(b) 15 watts R.M.S. into 8 ohms
'Phono: — 48 dB
Tape: — 44 dB
Auxiliary: — 60 dB

Total Harmonic Distortion

With tone controls central

R.M.S. watts into 8 ohms	1.00 c/s	1 kc/s	10 kc/s
1	.42%	.4%	.35%
5	.24%	.3%	.27%
10	.24%	.25%	.26%
20	.25%	.29%	.9%
25	3.1%	.7%	3.5%

Cross Talk

—52 dB at 1 kc/s with other channel volume control at same setting. Worst case —48 dB with other channel at full volume control.

These figures compare with manufacturer's figures of:

20 kc/s — 50 dB
1 kc/s — 55 dB
20 kc/s — 40 dB

Intermodulation Distortion

1·3% for 50 c/s / 5 kc/s 4 : 1 ratio (in reasonable agreement with maker's figure of 1%).

Maximum 'Phono Sensitivity

3·1 mV for 20 watt R.M.S. into 8 ohms.

Frequency response (at 5 watts R.M.S.) with tone controls central. ± 1·5 dB from 30 c/s to 12 kc/s. + 1·5 dB — 2·8 dB 30 c/s to 25 kc/s.

Tone Controls

Bass max. cut at 30 c/s —25 dB
„ boost „ „ +12 dB
Treble max. cut at 15kc/s —20 dB
„ boost „ „ +14 dB

COMMENT

The otherwise quite excellent distortion figures and superior appearance of the amplifier are marred by the rapid increase of noise with the volume controls near maximum and the tone controls to heavy boost. The nature of the hum (50 c/s plus 150 c/s) indicates more attention to the power supply would reduce this source of hum — it could be the usual American trouble of a 60 c/s transformer designed pretty "close to the edge" being run on 50 c/s without redesign, certainly the third harmonic content indicates flux density trouble. With the treble control in maximum boost and with the gain well up an annoying amount of noise is apparent — on investigation this appears to be white noise starting at about 10 kc/s or 12 kc/s and extending well above the audible range. This is obviously transistor noise but further investigation was cut short by lack of time.

In summary, a good amplifier that needs slight improvements in the tone controls and a reduction in the high frequency noise. The retail price is slightly over £100.

This unit supplied by Elekon (O/seas) Ltd

ENQUIRY CARD AD. 22

SILICON DIODE POWER TRANSFORMERS AVAILABLE FROM BEACON RADIO LTD.

R98 T.V. POWER TRANSFORMER

For R.T.V. & H. 1959 and later T.V. Sets.
Delivers 260v @ 300mA D.C. Full wave voltage doubler.
230:115v A.C. @ 300mA D.C.
:12.6v C.T. @ 5A (2 windings ea. 6.3 @ 5A).
:0—6.3—7.5—9 @ .6A. Picture tube winding.
Choke:—C36. Use 400v P.I.V. Diodes.

R103 Stereo Power Transformer

R.T.V. & H. Aug. 60. 7w Stereo.
230:245v @ 150mA. D.C.
:104v @ 150mA D.C. Voltage doubler Rect.
:6.3v C.T. @ 5A.
Choke:—C42. Use 400v P.I.V. Diodes.

R104 Stereo Power Transformer. 10w

320v @ 320mA. Voltage doubler Rect.
230:130v @ 320mA.
:6.3v @ 6A.
Choke:—C49. Use 500v P.I.V. Diodes.

R105 T.V. Power Transformer For Philips T.V. Kitsets

220v @ 420mA D.C. Voltage Doubler Rect.
230:106v @ 420mA D.C.
:6.3v @ 10A.
:0—6.3—7.5—9 Ov @ 0.3A. Picture tube Winding.
Choke:—C45. Use 400v P.I.V. Diodes.

R106 T.V. Power Transformer for Philips T.V. Kitsets

This type similar to R105 but less Picture Tube boost taps. Main Fils. 12.6v C.T. @ 5A.
220v @ 420mA D.C. Voltage Doubler Rect.
230:106v @ 420mA D.C.
:12.6v C.T. @ 5A (2 windings 6.30v @ 5A each).
:6.3v @ .3A Picture tube winding.
Choke:—C45. Use 400v P.I.V. Diodes.

R108 Small Stereo Headphone Power Transformer

250v @ 22mA D.C.
230:110v @ 22mA D.C. Voltage doubler Rect.
:6.3 @ 0.86A.
Choke:—C41. Use 400v P.I.V. Diodes.

R110 T.V. Power Transformer. For Philips T.V. Kitsets

This transformer uses full wave bridge rectifier. Requires no limiting resistor unlike equivalent voltage double types, also has advantage of no insulated capacitor and lower ripple output with smaller choke.
Output 220v @ 420mA D.C.
230:172v @ 420mA D.C. Full wave bridge Rect:
:12.6v C.T. @ 5A (2 only 6.3v winding @ 5A).
:6.3v @ .3A Picture tube winding.
Choke:—C50. Use 400v P.I.V. Diodes.

R111 T.V. Power Transformer

Similar to R110 but for R.C.A. type Kitsets.
260v @ 350mA from Rect.
230:207v @ 350mA D.C. Full wave bridge Rect.
:12.6v C.T. @ 5A (2 only 6.3v windings each 5A).
:6.3v @ 0.6A. Picture tube winding.
Choke:—C42. Use 400v P.I.V. Diodes.

R112 Oscilloscope Power Transformer

R.T.V. & H. 1963. Calibrated.
230:110v @ 80mA D.C. Full wave voltage doubler.
:6.3v @ 2.4A.
:6.3v @ 1A.
:6.3v @ 1A.
Use 400v P.I.V. Diodes.

BEACON RADIO LIMITED

Corner Brown and Fitzroy Sts., Ponsonby, Auckland. P.O. Box 2757. Telephone 16-164 (3 lines)

R. E. & C. TRANSISTERCOM

—Continued from page 11

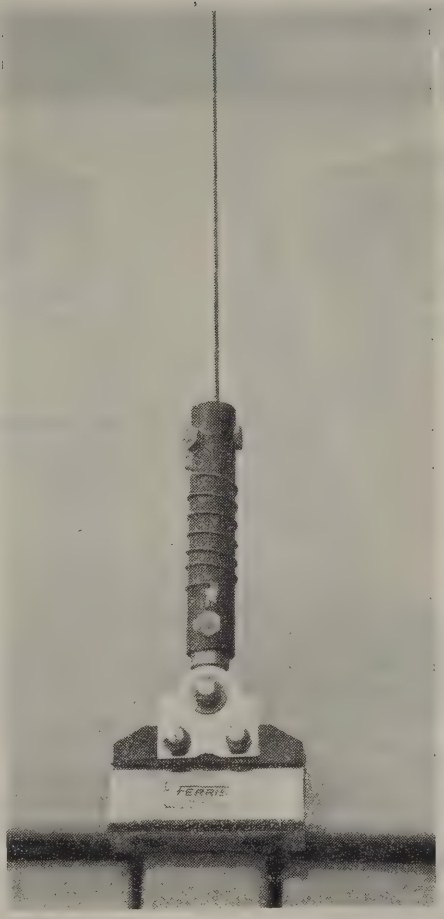
the amplifier when operating on "call-in". In this case a small relay should be used to control the battery line, with the remote switch controlling the relay coil. Small relays requiring only a few milliamperes for operation are readily available, and these will fit into the space alongside the battery. One type which is ideal for this purpose is the small "reed" relay. These are available in this country and also on the English Disposal market.

If a remote switching line is used, it is advisable to place a 500 to 1000 mfd. 12v. capacitor between positive and negative rail to keep the A.C. impedance of the battery line to a low value.

Final Adjustment of the Amplifier

When everything is wired up and checked over, then temporarily break the line between the collector of the AC117 and the negative line, and insert a milliammeter reading say 0-25 mA. Set the 500 ohm resistance to maximum and switch on. There should be very little current flowing, but adjustment of the 500 ohm resistance should cause an increase of current. Adjust this to 5 mA, or so. Now the next thing to do is to measure the voltage at the common emitter point of the output pair; this should be close to 4·5 volts, when a 9 volt supply is in use. If this is not so, then the 22k ohm resistor should be altered to bring this about. The figure will lie between 18 and 39k ohms depending on the current gain of the AC122 used as the driver. Check the standing current again and re-adjust if necessary to 5 mA.

Note: If a suitable 500 ohm trimmer resistor is not available then a physically larger unit with flying leads can be used to set up the bias. The value of the variable can then be measured and a fixed resistance of the same value wired in permanently.



⅝th Wavelength Vertical Mobile Antenna

Illustrated above is the finished version of the ⅝th Wavelength Antenna described in detail in our April 1965 issue. Although a commercial version has been produced by an English firm this feature was designed to provide enthusiasts with easily carried out modifications to an aerial already available on the local market. Readers are referred to that issue for an accurate constructional diagram.

ENQUIRY CARD AD. 13

Radio Mr^ Serviceman

Our radio broadcast universal replacement coils will replace any damaged aerial, R.F. or oscillator coil. Designed to assist you in maintaining first-class service to your clients.

Aerial Type 40
R.F. Type 45
Osc. Type 41

Write for alignment procedure Sheet № 5/40

New factory address:
Cameron Rd. South, Greerton, Tauranga

Inductance Specialists LTD.

NEW NAME FOR EDDYSTONE RECEIVER COMPANY

Stratton & Company Ltd., manufacturers of the well-known Eddystone range of professional radio communication receivers and accessories since 1923, has now been officially renamed Eddystone Radio Limited. This follows the announcement last March that the Stratton radio interests had been acquired from Laughton and Sons Ltd., by English Electric, and that the company would be operated as a subsidiary of The Marconi Company.

* * *

S.T.C. EXECUTIVE

Mr. G. C. Remington, C.M.G., has been appointed chairman of Standard Telephones and Cables Pty. Ltd., the Australian and N.Z. subsidiary of the American International Telephone and Telegraph Corporation.

Mr. Remington, a prominent Sydney solicitor, is chairman of Rolls Royce of Australia and of Crane Australia Pty. Limited, the Australian subsidiary of the Crane Corporation of America. He is also Director of W. R. Carpenter Holdings Limited, Dalton Bros. Holdings Limited, and Scottish Australia Co. Ltd.

LISTENING POST
—from page 25

CANADA: The CBC Northern Service is heard at weak strength at 0700 on 9,625. The Northern Service closes soon after the news bulletin at this time and reopens with the New Zealand transmission at 0730 on the same frequency.

KOREA: The Voice of Free Korea broadcasts on 15,125 with an English programme at 0630 - 0700 and French after 0700. Thirteen minutes of English news can be heard at 0630. Reception is good.

SWEDEN: Radio Sweden broadcasts in English to the Far East at 1230 on 15,195 and 17,845 and to South Asia at 1445 on 11,915 and 15,315.

MEDICAL ELECTRONICS

A list of references which we gratefully acknowledge.

(1) Cole, D. S. & Yarrow, S., "Artificial Electrical Pacing for Heart Block", N.Z. Med. J., 1964, 63, p.127. (2) Borrie, J. & Lichter, I., "Artificial Pacing for Heart Block", N.Z. Med. J., 1964, 63, p.31. (3) "Electronics and Medicine", Documenta Geigy, (Switzerland) 1965. (4) Rowlands, E. N. & Wolff, H. S., "The Radio Pill", Brit. Comm. & Electr., 1960, 6, p.598. (5) Wolff, H. S., McCall, J. & Baker, J. A., "Semiconductor Electrometer Amplifiers", Brit. Comm. & Electr., 1962, 9, p.120. (6) Bryant, G. H., "Electrical Measurements and measuring devices in Medicine", Elect. Rev. (U.K.), 1964, 175, p.736.

ENQUIRY CARD AD. 23

focus on our agencies

DATAPULSE INCORPORATED (U.S.A.)

Generator model 106A. Repetition rates to 12.0 mc/s. Amplitude to 12 volts into 50Ω. Double pulse mode and variable pulse widths from 25 Nanosec to 5 Millisec. Linear variable rise and fall time control from less than 10 Nanoseconds.
Jitter less than 0.1%.
Accuracy within ± 5%.

A/S DANBRIDGE

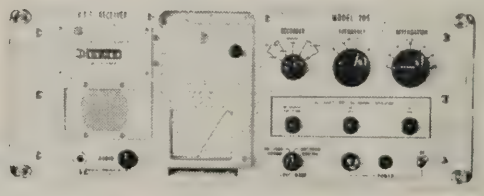
Precision Decade Resistance Box.
The resistors are specially aged and checked over long periods to ensure the highest possible stability. The switches employ hard silver contacts providing eight separate contact points in parallel in each position. Thus an extremely low and constant switch resistance (about 1 milliohm per decade with variations less than 0.2 milliohms) is obtained. These values are maintained for long periods of use.

RADIO FREQUENCY LABORATORIES

Model 1965 Universal Gaussmeter.
Three instruments in one package. Measure absolute magnetic field densities. Make differential or gradient flux measurements. Detect incremental variations of a Field. A precision Hall-effect Gaussmeter capable of magnetic field measurements in the range of .03 gauss to over 20,000 gausses. DC and AC from 20 HZ to 400 HZ.

MONTRONICS INCORPORATED

Model 205 VLF Receiver.
Frequencies 16, 20, 24 and 60 kc.
Sensitivity 0.05 microvolt at —20 db signal-to-noise ratio and 50% duty cycle.
Dynamic Range Greater than 140 db; 80 db with no operator control or AGC.
Servo Bandwidth 1 x 10^{-7} of received frequency.
Readout Front panel chart recording and digital accumulator in step of 0.1 microsecond.
Power Requirements 115/230 volts, ± 10%, 50-440 cps, less than 30 watts.



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SAMPLE ELECTRONICS (N.Z.) LTD.

8 MATIPO STREET, ONEHUNGA, S.E.5, AUCKLAND, NEW ZEALAND
TELEPHONE 565-361

SERVICE AND CALIBRATION FACILITIES AVAILABLE

LETTER — from page 5.

converter for 80 metre operation. I was wondering would you be able to write out a figure of the chassis showing component layout in detail. I also wanted to know which of the three gangs in the circuit is separate from the other two, c1, c2 or c3.

MALCOLM TAPP,
Timaru

The converter you mention was in use in the middle of 1962 but since that time has been superceded by more advanced, transistorised equipment. Consequently the unit, being no longer in service, was stripped to recover the major components, for further development work. However, I feel that the layout of all the more important components can be seen in the photographs associated with the article. In the circuit, c1, the aerial coil tuning gang is a single unit "Polar" capacitor with a shaft extending through front and rear. This enables a coupling to be used to join the shafts of c1 and c2/c3. c2/c3 is a "Polar" 2-gang of similar capacity. This coupling and the 2-gang capacitor can be seen in the top photo in the article. —Ed.

ENQUIRY CARD AD. 1

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For Sale to Dealers and Bulk Buyers.

Ex U.K. television spares, including Valves, Electrolytic Condensers, Turret Tuners, Variable Potentiometers, LF Chokes, Rectifiers, Loudspeakers, Transformers—Audio, Frame and line Output and Osc., IF Transformers.

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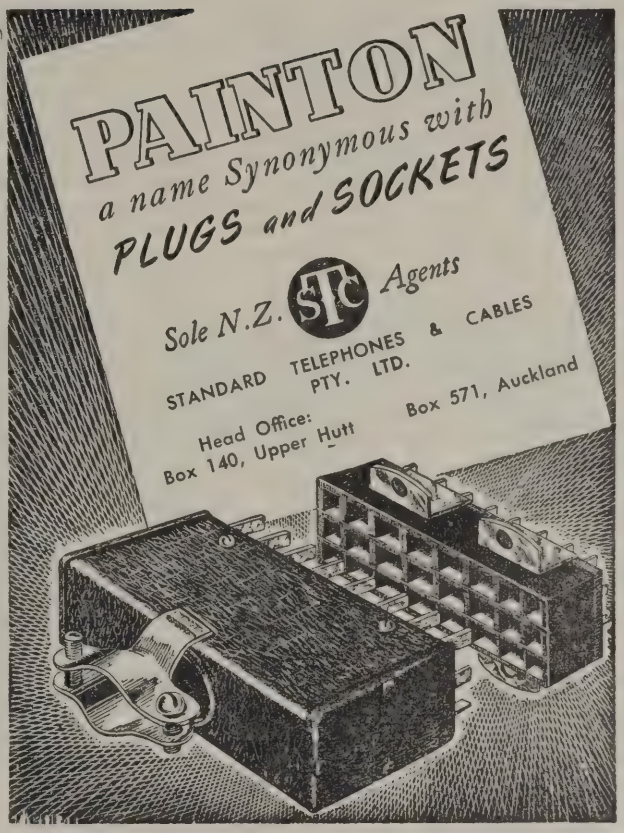
WOOTTON, 152-4 WEST STREET, CREWE, CHESHIRE, ENGLAND

ENQUIRY CARD AD. 19



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New Products

SPECIAL-PURPOSE TUBES FOR PROFESSIONAL APPLICATIONS

Increasing automation in the photo-electronic sector, is seeing more and more photoconductors employed. AWA have therefore decided to commence production of four types which are intended for manifold applications. The light-sensitive material of these photo-conductors is cadmium sulphide, whose relative spectral sensitivity is between 450 and 850 nm. The maximum spectral sensitivity is at 660 nm approximately.

Principal technical data is:

	RPY 10	RPY 11	RPY 12	RPY 25
Light-sensitive area	approx. 1	100	300	75mm²
Photocurrent	0.05-0.25	2-12	6-30	2-12mA
Dark Current	= 5	= 20	= 20	= 10uA
Peak Load at 25° C	100	250	1000	200mW

Photoconductors possess the advantage over photo-electric cells, that they may be operated with higher loads, and consequently these currents may be used to energise relay contacts. They are utilised for varying purposes such as for radiation detection, control and regulating function and in data processing. The four photoconductors differ as regards load and size.

The RPY 10 is very small. The photoconductor RPY 11 is provided with solder leads and two editions can be supplied for vertical and horizontal incidence of light. The RPY 12 is mounted on a Pico 7 base, whereas the RPY 25 is a plastic type with a glass cap.

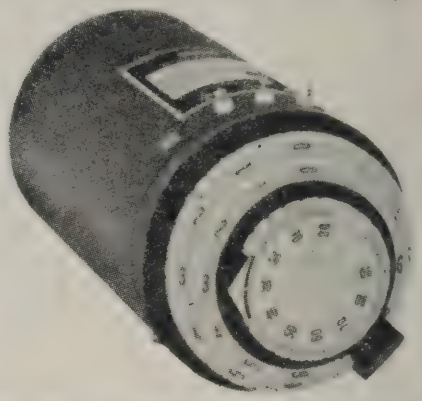
To meet the growing demand for numerical indicating tubes for the digital indication of measuring valves, such tubes are now included in the AWA range. The tubes concerned are types ZM 1020 and ZM 1080 and for the indication of symbols such as + — A V %, the ZM 1021, which is absolutely identical with type ZM 1020 in electrical aspects. On types ZM 1020 and ZM 1021 indication is effected at the front of digits 0 to 15 mm high and symbols; on type ZM 1080 at the side by digits 13 mm high. Type ZM 1080 is provided with flying leads for soldering.

Numerical indicating tubes are employed in all cases where measuring values or computer results shall be indicated. By reading off the values direct, much more accurate results are obtained than by reading an indicator instrument.

ENQUIRY 158

NEW HIGH RESOLUTION DECADE POTENTIOMETERS

The John Fluke models 40A, 50A/C, and 60A/C are precision voltage dividers consisting of high accuracy fixed resistors and precision wire wound potentiometers which provide continuous interpolation between decade steps. This combination provides linearity accuracy to better than one part in two thousand and a resolution of more than 0.02%.



Control is provided by two dials mounted on coaxial shafts, permitting the unit to be mounted on a single ⅜" diameter panel hole. All resistors are wire wound using wire with a temperature coefficient of less than ± 0.002% per degree celsius. Consequently, voltage accuracy is ordinarily independent of Ambient temperature.

ENQUIRY 169

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JULY, 1965

PROTECTION FOR MISSILE COMPUTERS

To protect delicate computer modules, to be used in U.S. Polaris missiles guidance systems, during assembly and shipment, an American company is using flexible polyethylene foam.

In assembly production, a circuit is laid on a block of this Ethafoam and the components — resistors, capacitors, diodes, etc. — are pushed through the holes into foam. The assembly is completed and staked together, the leads are with-drawn from the block and trimmed.

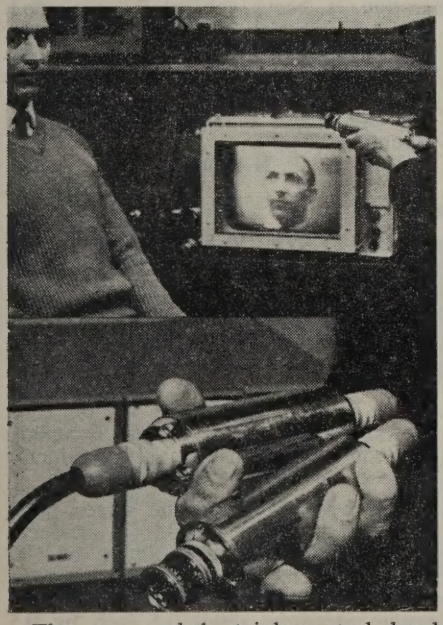
In this particular application, contamination is a big factor since the presence of any foreign substance could cause serious malfunction of the module. Thus, any foam substance must be of such a material as to not flake nor emit dust. Since the wire leads are gold-plated, the foam also must be sufficiently soft to prohibit any abrasive action. Corrosion is also an extremely critical problem, and this foam material does not absorb or trap moisture.

ENQUIRY 188

* * *

POCKET TELEVISION PROBE

A new closed circuit television camera channel offers a camera head only slightly larger than a pocket torch. This new camera is fully transistorised and capable of operating on 405, 525 or 625 line standards at the touch of a switch incorporated in the unit. The rugged construction of the camera head permits rough handling in difficult locations. Nevertheless it produces high resolution pictures even where poor levels of illumination are involved.



The two sealed stainless steel head cylinders are 4.5 inches in length and 1.7 inches in diameter. They can be separated when in use by up to 100 feet of connecting cable and the camera head may be separated by 1,000 feet of cable from the camera control unit, syno pulse generator and power unit which complete the camera channel. These three units are housed in small modular metal cases of the same size.

ENQUIRY 186

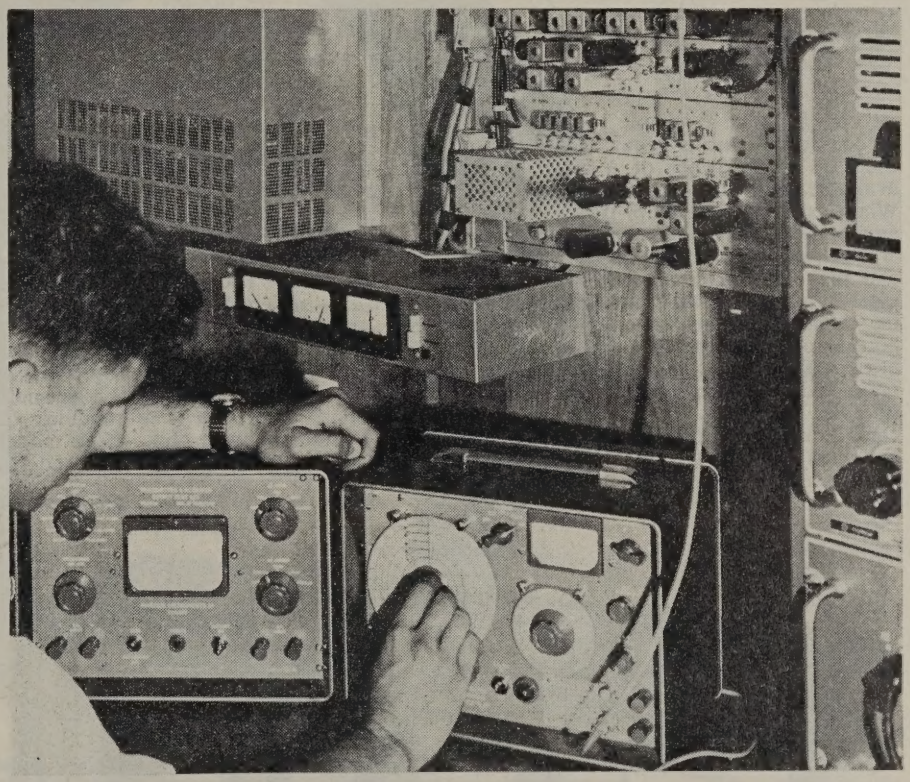
WELLINGTON HARBOUR BOARD COMMUNICATION NETWORK

Amalgamated Wireless (Australasia) N.Z. Limited have been awarded an order by the Wellington Harbour Board for a complete maritime VHF/FM installation to provide improved communication for port and harbour control.

The Hague Agreement of 1957 established operating standards for VHF communications between ships and harbour authorities on a world-wide basis. Because of the superiority of frequency modulated VHF for short range working, this system was adopted internationally and a band of frequencies was reserved for harbour and port communications. A large number of channels have been set aside for this purpose and each channel is allocated a specific role.

Marconi Marine transistorised VHF radiotelephones have been specified for Beacon Hill Signal Station, the wharf control tower, Harbourmaster's office, and the pilot vessels. The Telefunken Teleport VI portable was chosen for the pilots' use on non VHF equipped vessels.

The complete system is being engineered by AWA who will also install and maintain the equipment.



A similar installation to the Wellington Harbour Board Communication System was supplied by AWA to the Whangarei Harbour Board. Picture shows the control desk at Marsden Point. From here navigational information and instructions can be communicated instantly to ships, tugs, pilot vessels and other craft in the harbour surveillance area.

ENQUIRY 179

EXTENSIBLE VOICE FREQUENCY TELEGRAPH SYSTEM

New 24-duplex-channel voice frequency telegraph equipment that is ideally suited for the rapidly expanding telex service and the more traditional telegraph services, has been introduced.

The equipment, completely transistorised, employs frequency shift modulation, operates at 50 bauds (up to 75 bauds for some applications) over any 4-wire speech circuit effectively transmitting frequencies between 300 c/s and 3400 c/s.

One of the principal features is that of being readily extensible by any number of channels from a basic 6-duplex-channel system up to a total of 24-duplex channels. Furthermore, by using the latest C.A.S.E. (Type 62) construction up to four complete 24-channel systems can be mounted in a standard 7ft 6ins high-rack and five systems in a 9ft rack.

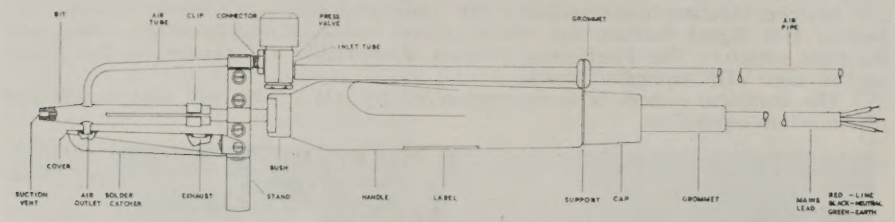
Another feature is a choice of output stages—either transistor or mercury wetted reed relay. Whilst the transistor output stage has an indefinitely long life it is slightly more expensive and less flexible in application than the mercury wetted reed-relay, which has a life expectancy of at least 1,000,000,000 operations at 50 milliamps output and covers a wider range of applications.

An optional facility provides correction for bearer channel asynchronism before the V.F.T. tones reach their respective filters. If required telegraph battery supplies can be provided by equipment mounted in the rack. Orders for this British equipment have been received from N.Z.

ENQUIRY 191

DE-SOLDERING TOOLS

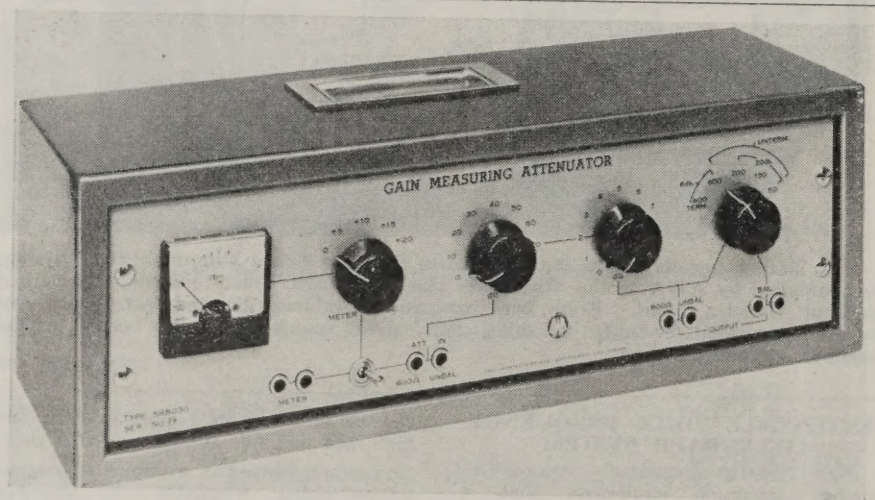
The difficulty of unsoldering a component from an electronic assembly becomes apparent when the component has more than one or two soldering tags, such as an I.F. transformer or a valveholder. A number of manufacturers have made a tool which will remove molten solder by suction but this method may also remove flux residues and dirt particles, creating blockages. To avoid this troublesome feature, de-soldering irons have been designed to work on compressed air, and suction is only created by way of the "Venturi" principle, in the "bit" of the tool. The result is that the tool continually cleans itself by means of the high pressure air flow.



In this way a reliable tool has been created which is always ready for use and as compressed air is required for it's operation, an ordinary foot pump such as is used by every owner of a motor car may be used. If a compressed air line is available, as in most factories, the efficiency of the tool is of course greatly improved. When using a foot pump, it is only necessary to press the foot lever down to create ample pressure for successful operation.

A strong nylon air pipe is provided with two adaptors, one for air line connection and the other male thread to fit a standard foot pump. The stainless steel solder catcher is fitted with a cover in order to prevent any solder fragments falling on to the circuit board or sub-assembly. This catcher assembly is hinged to provide easy access for the removal of the solder. Of the two models available, Model ESS, fitted with 5/32" 4 mm diameter bit is suitable for all normal de-soldering work on radio and television receivers and similar work. The smaller, Model GSS is specially suitable for work on miniature and micro-miniature work, such as modules for computors, hearing aids and is fitted with 3/32" 2.4 mm diameter bit. Both models are fitted with a 6 ft. 1.80 m nylon air line, 6 ft. 1.80 m 3 core flexible lead and two adaptors.

ENQUIRY 192



GAIN MEASURING ATTENUATOR

This new Gain-Measuring Attenuator, type 5R830, has been designed to simplify the work of setting up equipment for various measurements. It is particularly useful for broadcasting stations and laboratories, where it provides accurate calibration of the level from an audio-frequency source for use when making measurements of frequency response, gain, distortion, and other factors.

The unit consists essentially of three-sections, namely, a level indicator with range switch, an unbalanced 600-ohm attenuator system and an impedance-matching section to give a choice of balanced output impedances to suit 600-200-150- or 50-ohm circuits.

The metering circuit is connected to jacks which enables it to be used externally independently of the other sections of the unit.

The attenuator is built on a steel front panel and has a dust-cover fitted from the rear. All connections are made by means of jacks on the front panel. These jacks are of a special type that accept tip-ring-sleeve or carrier type plugs.

Alternatively, the unit can be supplied in a convenient and robust carrying case.

ENQUIRY 190

NEW SYSTEM OF MEASURING EQUIPMENT

Basis of the Dymar system is the Type 70 meter unit, which provides a precision 5 in. meter movement and comprehensive, well regulated power supplies. Into this may be plugged numerous measuring instruments. Initially these include: wide band millivoltmeter, d.c. microvoltmeter, d.c. kilovoltmeter, a.f. signal generator and a noise factor meter.

The interchangeable panels provide great flexibility at minimum cost and the range of instruments available for connection is being continually expanded. The unit is also available for 19 in. rack mounting. A blank plug-in chassis is available for the user to build his own measuring or monitoring instrument. The unit is also available for 19 in. rack mounting.

N.Z. Agent: P. H. Rothschild & Co. Ltd.

ENQUIRY 176

* * *

SOLID-STATE ELECTRO-OPTICAL IMAGING SYSTEM

A camera system that uses a solid-state imaging device instead of an electronic tube for light sensing and image conversion has been developed in U.S. under a NASA contract. The imaging device is a mosaic made up of 2500 phototransistors. The mosaic is square with 50 light sensitive semiconductor elements on a side.

It is believed to be the largest integrated structure ever built. It produces an image that has a resolution of 100 lines per inch. The sensitive area of each individual phototransistor in the mosaic measures about 0.5 inch by 0.5 inch out of an over-all size of 0.6 inch by 0.6 inch.

Molecular electronic circuitry is used throughout the camera system to perform the electronic functions necessary to obtain a video signal output: The camera uses a standard 16-millimeter lens. Without the lens, the camera measures 6 by 4 by 2¾ ins. in size.

ENQUIRY 195

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ENQUIRY CARD AD. 25

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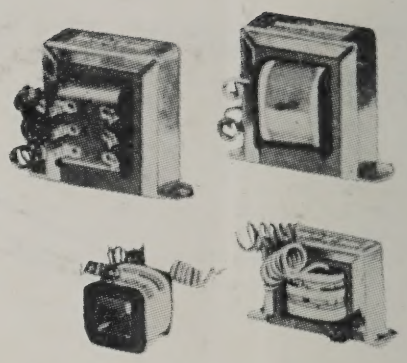
GC/2676/64

ENQUIRY CARD AD. 26

OUTPUT TRANSFORMERS to your requirements

by ATC



We Manufacture many types of Output Transformers for New Equipment and Replacement Repair Work.

WINDINGS AVAILABLE FOR OP1-14 and OP18-22 INCLUSIVE

Type No.	Wattage	Impedance Ratio	Bobbin Size	Colour Code	Mounting
†OP1	3	5K/3 ohms	9/16 Square	Red	Clamp
†OP2	3	7K/3 ,,	9/16 ,,	Yellow	,,
†OP3	3	10K/3 ,,	9/16 ,,	White	,,
†OP3 C	3	10KCT/3 ohms	9/16 ,,	White	,,
†OP4	6	5K/3 ,,	¾ Square	Red	,,
†OP5	6	7K/3 ,,	¾ ,,	Yellow	,,
†OP6	6	10KCT/3 ,,	¾ ,,	White	,,
†OP7	6	14KCT/3 ,,	¾ ,,	Black	,,
†OP8	4.5	5K/3 ,,	11/16 x 13/16	Red	,,
†OP9	4.5	7K/3 ,,	11/16 x 13/16	Yellow	,,
†OP10	4.5	10KCT/3 ,,	11/16 x 13/16	White	,,
†OP11	4.5	14KCT/3 ,,	11/16 x 13/16	Black	,,
†OP12	4.5	Universal	11/16 x 13/16	—	,,
†OP13	6	Universal	¾ x ¾	—	,,
†OP14	10W	Universal	⅞ x ⅞	—	,,
OP15	20	5KCT/Univ.	1" x 1¼	—	Side covers & feet
OP16	20	6.6KCT/ ,,	1" x 1¼	—	,,
OP17	20	10KCT/ ,,	1" x 1¼	—	,,
OP21	2W	5K/3	½"	Red	Windings Only
OP22	2W	7K/3	½"	Yellow	,, ,,
OP23	35W	5KCT/Univ.	2" x 1¼	—	Covers & Feet
OP24	35	6.6KCT/ ,,	2" x 1¼	—	,, ,,
OP25	35	10KCT/ ,,	2" x 1¼	—	,, ,,
OP26	15W	Hifi 5KCT/15 ohms	2" x 1¼	—	,, ,,
OP27	15W	Hifii 8KCT/15 ,,	2" x 1¼	—	,, ,,
OP28	15W	Hifii 10KCT/15 ,,	2" x 1¼	—	,, ,,
		ULTRA LINEAR TYPE			
OP29	20W	6.6KCT/15 ohms	2" x 1¼	—	,, ,,
OP30	20	8.5KCT/15 ,,	2" x 1¼	—	,, ,,
OP31	20	10KCT/15 ,,	2" x 1¼	—	,, ,,
		LOW POWER EXTENDED RANGE			
OP32	6W	8KCT/7 ohms	1¼" x ⅞"	—	Clamp
OP33	6W	8KCT/15 ,,	1¼" x ⅞"	—	Clamp
OP34	3W	Universal	9/16 x 9/16	—	,,
OP35	6W	10KCT/15-7.5-3 ohms	¾ x ¾	—	,,
OP36					
OP37 / OP50	8W U/L / 10W stereo	9KCT/15-7.5-3 ohms	⅞" x ⅞"	—	,,

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